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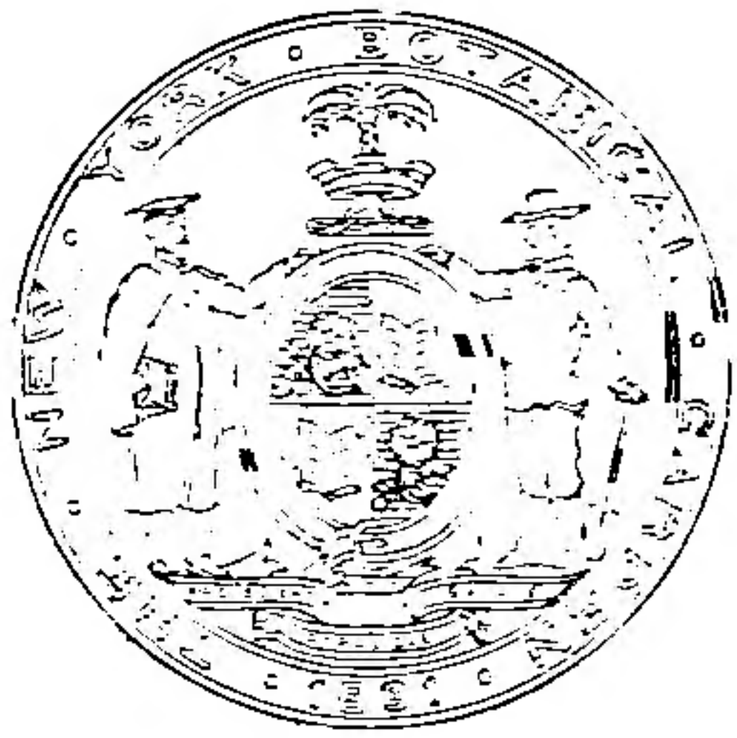

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BOTANIZING IN THE HIGHER ALLEGHANY MOUNTAINS.—I. WEST VIRGINIA

I spent my summer vacation of 1925 collecting in the higher Alleghany Mountains of Virginia, West Virginia, North Carolina, and Tennessee. Dr. Britton, Director-in-Chief of The New York Botanical Garden, permitted me to remain in the field for a second month on condition that I secured living plants for the outdoor plantations, and herbarium material. About 150 species of living plants were sent in from the field and about 3,000 herbarium specimens were secured.

I was fortunate to secure as a companion Mr. John T. Perry, a graduate of Massachusetts Agricultural College. We started on the 10th of June from New York by automobile. During the first three days we did no botanizing, spending the days on the road and the nights at tourist camps, near Kutztown, Pa., at Gettysburg, Pa., and Endless Caverns, Va. We spent a few hours in seeing the battlefield near Gettysburg, and the Caverns. On the 13th we passed through Staunton, Va., buying some extra supplies. Then we turned westward and camped over night near the Fire Warden's house at the base of the Shenandoah Mountains.

The following morning we crossed said mountain range, which now constitutes a United States forest reserve. The mountain had a typical Alleghanian forest flora clear to the top of the ridge, consisting mostly of several species of oaks and maples, chestnut, yellow birch, and large-toothed aspen. The Alleghanies here consist of several parallel ridges reaching an altitude of 3,000–4,500 feet, the valleys between them being 1,400–1,600 feet high. We stopped only at one place and botanized for about half an hour,

just after we had crossed the summit of Bull Pasture Mountains, where the road makes a wide curve around a naked ridge before it begins the steeper incline down the west side. Here we found three huckleberries, *Polycodium candicans, Vaccinium pallidum,* and an undescribed species of *Vaccinium,* together with *Ceanothus americanus,* and *Rosa carolina.* Among herbaceous plants may be mentioned *Heuchera pubescens, Antennaria neodioica, Convolvulus spithamaeus, Houstonia angustifolia, Cracca virginiana, Danthonia spicata, Asclepias quadrifolia, Hieracium Greenei,* and *Pentstemon hirsutum.* On our return from West Virginia we collected awhile on the top of the ridge while the automobile cooled off a little. Here we added to the collection *Galium latifolium, Arenaria serpyllifolia, Zizia cordata, Juncus tenuis, Onychia canadensis,* and *O. montana.*

In the evening, July 14, we reached Monterey and camped by the old mill north of the village. On inquiring about the best road to reach the highest mountains of West Virginia, we were advised to take the Franklin road and turn to the left just after the road had crossed the river at Strait Creek. The left road would take us through Crabbottom, and, turning north, to Mr. Simmons' farm, situated in the valley between two of the higher mountains, Snowy Mountain and Panther Mountain. Mr. Simmons permitted us to camp in his hay-field, gave us much valuable information and many references and his oldest son, Martin, a school teacher, volunteered as a guide on our first day's trip up Panther Mountain about 4,500 feet high. In climbing the mountain, he chose a nearly direct line, which took us first through pasture lands, rather uninteresting from a botanical standpoint. The only thing of interest was a strawberry, *Fragaria australis,* and an unknown species of blue-eyed grass, *Sisyrinchium.* On the higher slopes we entered a typical Alleghanian forest of oaks, maples, chestnuts, hickories, etc. The undergrowth consisted of such plants as *Porteranthus trifoliatus, Rubus carolinianus, R. nigrobaccus, R. canadensis, Grossularia rotundifolia, Aquilegia coccinea, Gaultheria procumbens, Viburnum cassinoides,* etc. Approaching the summit, we found the flora to begin to change. The common hardwoods began to give way and their place was taken by two species of pine, *Pinus virginiana* and *P pungens,* and the scrub-oak, *Quercus ilicifolia.* The highest point of the

mountain consists of naked cliffs forming the precipitous southwestern rim of the mountain. The crevices of this rim and the sandy soil behind it were filled or covered by a mat consisting mainly of a mixture of two plants of altogether different distribution, *Hudsonia tomentosa,* a typical sand-barren plant, and *Paronychia argyrocoma,* a plant characteristic of the exposed crags of the higher Alleghanies. To these were added here and there *Sibbaldiopsis tridentata* and *Houstonia caerulea.* It being rather late in the afternoon, we did not have time to investigate the almost flat plateau, which stretched itself for many miles in a northerly direction. We struck a trail which led along a hogback and took us to the wagon road about two miles west of the pass. We returned by this road over the pass to our camp.

Two days later we visited again the top of Panther, reaching it by the trail mentioned, and spent most of the day on this tableland. We found to our surprise that the flora here was scarcely Alleghanian. It seemed as if we had suddenly been transported to the sand-barrens of New Jersey. The soil was evidently very shallow, there were many wet places and a few small springs. The wood flora consisted mostly of scattered pines, mostly *Pinus virginiana,* but in many places *P pungens* had taken its place. I think that I also saw *P. rigida,* though I might be mistaken, as I have no specimens in my collection. Mixed with the pines were growing the large-toothed aspen, witch hazel, mountain ash, and the purple choke-berry (*Aronia atropurpurea*). Among these were growing many northern herbs, as the yellow ladies'-slipper, the bristly sarsaparilla (*Aralia hispida*), three lycopods, bunchberry (*Cornus canadensis*), the swamp blackberry (*Rubus hispidus*), etc. In more open places were found big stretches of Ericaceous and Vacciniaceous plants, also here a mixture of northern and Alleghanian species, as *Menziesia pilosa, Kalmia latifolia, Polycodium candicans, Vaccinium pennsylvanicum, V canadense,* and *Gaylussacia baccata.* In the crevices of the rim I found a saxifrage (*Spathularia petiolaris*), in the talus below it the beautiful bleeding heart (*Bicuculla eximia*), and around a spring further down *Micranthes micranthidifolia, Veratrum viride,* and a few Carices. Just before we struck the trail going home, we passed through a depression, through which ran a little brook. This hollow contained a true northern flora. Besides the

red spruce (*Picea rubens*), which is common on the highest mountains in the southern Alleghanies, the wooded flora consisted of northern trees, as yellow birch (*Betula lutea*), canoe birch (*B. papyrifera*), hemlock (*Tsuga candensis*), beaked willow (*Salix Bebbiana*), white spruce (*Picea canadensis*), and sugar maple (*Acer saccharum*).

On June 17 we climbed Snowy Mountain, also about 4,500 feet high. It differs from Panther in having no flat top, but forms a sharp ridge running northwest to southeast, the northeastern slope being steeper than the southwestern. Though about as high as Panther, it has nothing of the northern flora, the Alleghanian hardwood forest reaching clear to the top. On the southwestern slopes it consisted mostly of chestnut and oaks. The chestnut was, as far as I could see, free from blight. On the northeastern slope the forest was more mixed, maples and birches being more common. If the birches were all *B. lutea* or if *B. alleghanensis* was also found, I can not tell, as we did not find any catkins. Among the undergrowth may be mentioned *Triosteum perfoliatum, Convallaria majalis, Blephilia ciliata, Veronica officinalis, V serpyllifolia, Ranunculus allegheniensis, Juncoides bulbosum, Sedum ternatum*, and a new species of *Heuchera.*

On June 20 we broke camp, and headed for Spruce Knob, the highest mountain in West Virginia. We drove over the pass into the valley of Dry Run, which we ultimately had to cross. In this part of the state, wagon bridges are very scarce and fords furnish the only means of crossing for a car. Most of the settlers of the region use wagons or Ford automobiles, in which the carbureter is placed high up. We had a Chevrolet of 1923, in which the carbureter is placed at the bottom of the engine. The water in Dry Run was unusually high and the result was that our car stopped in the middle of the river, the water reaching into the wagon box. After some trouble we secured one of the settlers to tow us out.

We continued our journey to Circleville where we lunched, shipped living plants and herbarium specimens to New York, and laid in supplies. We drove back about two miles and camped over night.

The only way to reach near to the top of Spruce Knob by a car was from the south side. To make this place we had to cross Hunting Ground Mountain. The ascent was very steep and we

had to stop twice to cool the engine. On arriving to the little settlement on the plateau, we were told that the road to the forest ranger's house on Spruce Knob was too steep and too rough for an automobile and that we would find the mountain top more accessible if we drove four miles further west. We did so. Here one of the neighbors told us that he could show us a way through some pastures, past an abandoned sawmill, up to the upper part of the ranger's road, and that this way could easily be used by an auto. When we tried to cross the brook at the sawmill, the car stuck in the mud. It took us an hour of hard work and many slabs and poles from the lumber piles to get the car across. The road then began to be very rough and a big stone in it scraped and bent the pan under the crank-box. We gave up the idea of reaching the range-station by automobile and returned to the farm, after having built a temporary bridge of slabs over the brook. We found afterwards that the drain-cock of the crank-box was broken and the oil had run out. The bottom of the crank-box had to be taken out and the farmer took it to Circleville for repairs.

In the afternoon of June 22 we climbed the mountain as far as the house of the forest ranger, Mr. Moses Bennett, where we found accommodations for the night and also meals. The following morning we climbed to the fire-tower on the top, from which the whole country could be seen for miles and miles around.

The highest knoll of Spruce Knob (4,860 feet) has been covered with spruce forest, *Picea rubens,* but the west side and summit has been denuded, first by a lumber company and later by a severe forest fire. The old burns were now covered by *Rubus canadensis, Sorbus americana, Rubus carolinianus,* and *Menziesia pilosa.* We found no balsam on the mountain, though it has been reported for the region. I wish we had, as the species found in West Virginia has been in dispute. Some claim that it is *Abies balsamea,* others that it is *A. Fraseri.* The southern end still contains spruce forest, here and there interrupted by groves of birch and beech (*Betula lutea* and *Fagus grandiflora*), scattered mountain ash (*Sorbus americana*), and hawthorn (*Crataegus punctata*). Nearly all the beeches had been damaged by frost in the spring, and were just putting out a new crop of leaves, giv-

ing them a very peculiar appearance among the green birches. In an opening there was a veritable flower-garden, in which the most prominent plant was the luxuriant bleeding heart, *Bicuculla eximia.* In a pasture meadow near Mr. Bennett's farm there was found a conglomeration of umbellifers, as *Thaspium barbinode, T. trifoliatum, Cicuta Curtisii,* and *Heracleum lanatum.*

While staying near Mr. Simmons s place, we had heard from several persons that cattle had been poisoned by larkspurs. Mr. Simmons had tried to find some of the plants for us in one of his neighbor's pastures, but had not succeeded. Probably the neighbor had totally eradicated the pest. Mr. Bennett told us the same story, and said that he thought that he could show us a place where it grew. He took us to a gulley in the hardwoods north of his place, and here we found several hundred plants growing. It was, however, not a larkspur but a monkshood, an undescribed species of *Aconitum*, related to *A. reclinatum* but erect. In these two species the hood is high and slender, and can easily be mistaken for the spur of a *Delphinium.*

From Spruce Knob, we retraced our journey to Staunton, Va., where we received and posted mail and got supplies.

P A. Rydberg.

AN ATTEMPT TO AID THE NATURAL PROPAGATION OF HEMLOCKS

The remarkable forest of hemlock trees in The New York Botanical Garden in Bronx Park, forming the famous Hemlock Grove on the ridges west of the Bronx River, from the Boulder Bridge south about 3,000 feet to the old Lorillard snuff mill, has long been a feature of great interest and admiration. The total area of the grove as outlined, more or less thickly occupied by hemlocks, is about 40 acres; there are many scattered trees outside of the grove proper. A count of trees made in 1923, showed that large and small, seedlings not included, the total number of hemlock trees to be about 3,600.

This grove is of especial interest as the most southern considerable aggregation of hemlocks along the Atlantic Coast. The late Mr. William E. Dodge, who was one of the original incorporators of The New York Botanical Garden, characterized it as "the most precious natural possession of the City of New York."

Its preservation and perpetuation have, naturally, been given much consideration, by the managers of The New York Botanical Garden, by the Park Department and by all persons who have understood its peculiar significance and have known and appreciated its great beauty.

In the year 1895, when about 250 acres of Bronx Park were appropriated and set aside for the use of The New York Botanical Garden by the Commissioners of Public Parks, these two organizations agreed upon restrictions as to the treatment of the Hemlock Grove, which prevent cutting of trees, planting or any other changes, without mutual approval, as a measure of precaution. This[1] contract has now been in force for about thirty years, during which period the only changes made within the grove have been the removal of dead trees and weed trees from time to time, the erection of railings along the trails to prevent indiscriminate trampling by the multitudes of persons who visit these grounds in summer, and surfacing of parts of the trails. The general health and beauty of the forest have been maintained, and those who have known it throughout this period, or longer, see little change, except the loss of the many chestnut trees, formerly intermixed with the hemlocks, killed some years ago by the destructive chestnut blight.

This vigorous growth of hemlock at its southern stand near the seaboard has been the subject of scientific observation from time to time, as regards the growth of the trees, their production of cones, the germination of their seeds, the companion trees and undergrowth, the geology of the area, and other features.[2]

[1] Resolutions of the Commissioners of Public Parks, July 31st, 1895, and of the Scientific Directors of The New York Botanical Garden, August 19th, 1895, both published in the Bulletin of The New York Botanical Garden **1**: 13, 15. 1896 See also Charter of the City of New York, Sec. 625, which refers the carrying out of the contract to the Commissioner of Parks of the Borough of The Bronx.

[2] Britton, Trans. N. Y. Acad. Sci. **1**: 181. 1882.
Kemp, Bull. N. Y. Bot. Gard. **1**: 78–85. 1897.
Lloyd, Journ, N. Y. Bot. Gard. **1**: 97–100. 1900.
Harlow, ibid. **1**: 100, 101. 1900.
Britton, Trans. Bronx Soc. Arts & Sci. **1**: 5–13. 1906.
Gager, Journ. N. Y. Bot. Gard. **8**: 237–240. 1907.
Robinson, ibid. **10**: 81–87. 1909.
Hollick, ibid. **14**: 157–160. 1913.

In 1922, a comprehensive scientific investigation of the hemlock grove was organized by the Scientific Directors through the appointment of a special committee consisting of Mr. Barrington Moore, Professor Herbert M. Richards, Dr. H. A. Gleason, and Dr. A. B. Stout, in coöperation with the Yale Forest School, the New York State College of Forestry at Syracuse University, and the Department of Forestry of Cornell University. Comparative studies of soil, temperature, rainfall, and evaporation in the hemlock grove of the Garden, with other hemlock forests in Connecticut and northern New York were made during 1923. The first report of this committee was published in 1924.[3]

Soil studies are still going forward, with especial relation to the microscopic organisms, which may have much to do with the nutrition of trees and other plants.

In 1923 the impression was obtained that the natural reproduction of the hemlocks in Bronx Park was less abundant than in more northern forests. Late in that year seeds from these trees were obtained and sown in a greenhouse; these germinated early in 1924, and many fine young plants became available by the autumn of 1925. Meanwhile it had been deemed desirable to aid nature in perpetuating the grove. This conclusion was communicated to Hon. Joseph P. Hennessy, Commissioner of Parks of the Borough of The Bronx, in November, 1925, and his consent to the planting of 100 of these seedlings requested. Mr. Hennessy promptly gave his hearty approval of the project.

An area about 90 by 60 feet near the northwestern border of the grove, devoid of hemlocks or other large trees, was selected. This area is surrounded by thrifty medium-sized hemlocks and scattered hardwoods, and was already stocked with young white ash, black birch, and hornbeam about 6 to 10 feet tall. The birch and hornbeam were removed, and the ash thinned so as to leave here and there a light shade for the young hemlocks. Theoretically the light canopied ash over the shade-enduring hemlock should make an ideal combination. The work was accomplished on the afternoon of November 23, 1925; Mr. John F. Walsh and Mr. Henry Geiger delegated by Commissioner Hennessy represented the Park Department, the Hemlock Grove Committee of the Scientific Directors was represented by Mr. Moore and Dr.

[3] Bull. N. Y. Bot. Gard. **12**: 325–350. 1924

Gleason, and as it was deemed desirable that the boundaries of the plantation should be known to a number of persons, Dr. Howe, Assistant Director; Mr. Corbett, Superintendent of Buildings and Grounds; Mr. Boynton, Head Gardener, and Mr. Finley, Foreman Gardener, with four gardeners, all took part in the work of laying out and planting. The young trees were set six feet apart over the whole area, except where a ledge of rock prevented planting, and a plot was made recording the position of each plant, to the end that accurate observations can be made of the growth and survival of these seedlings.

The result of this apparently unique attempt to reinforce natural propagation of hemlocks within a hemlock grove will be observed with very great interest. It is proposed to grow a crop of seedlings in following years for further experimentation at other available points within the grove; a supply for 1926 planting is already available.

N. L. Britton,
Director-in-Chief.

CHRYSANTHEMUMS, 1925

The chrysanthemum displays of the autumn season, 1925, showed a reversal in the usual sequence; the hardy kinds being late because of a cold windy October, while the greenhouse plants flowered earlier and finished blooming directly at Thanksgiving, a season somewhat like the commercial one of last year. The hardy varieties were just reaching their ideal bloom when cut down on December 1st. Forty new varieties were given to the collection by the Bobbink & Atkins and Chas. H. Totty companies. Our in-door display at Conservatory Range No. 2 included three hundred plants of 95 varieties, mostly from the beautiful collection given by Elmer D. Smith & Co., of Adrian, Michigan, the varieties practically all originated by Mr Smith, one of the country's foremost chrysanthemum-breeders. A number of good sorts of the large flowered section were shown, but the bush varieties are coming more and more into favor and were especially attractive this year. Twenty-seven pompons of all sizes down to the tiny cap or buttons, ten single and fourteen anemone types grown as bush plants of varying heights, were included in

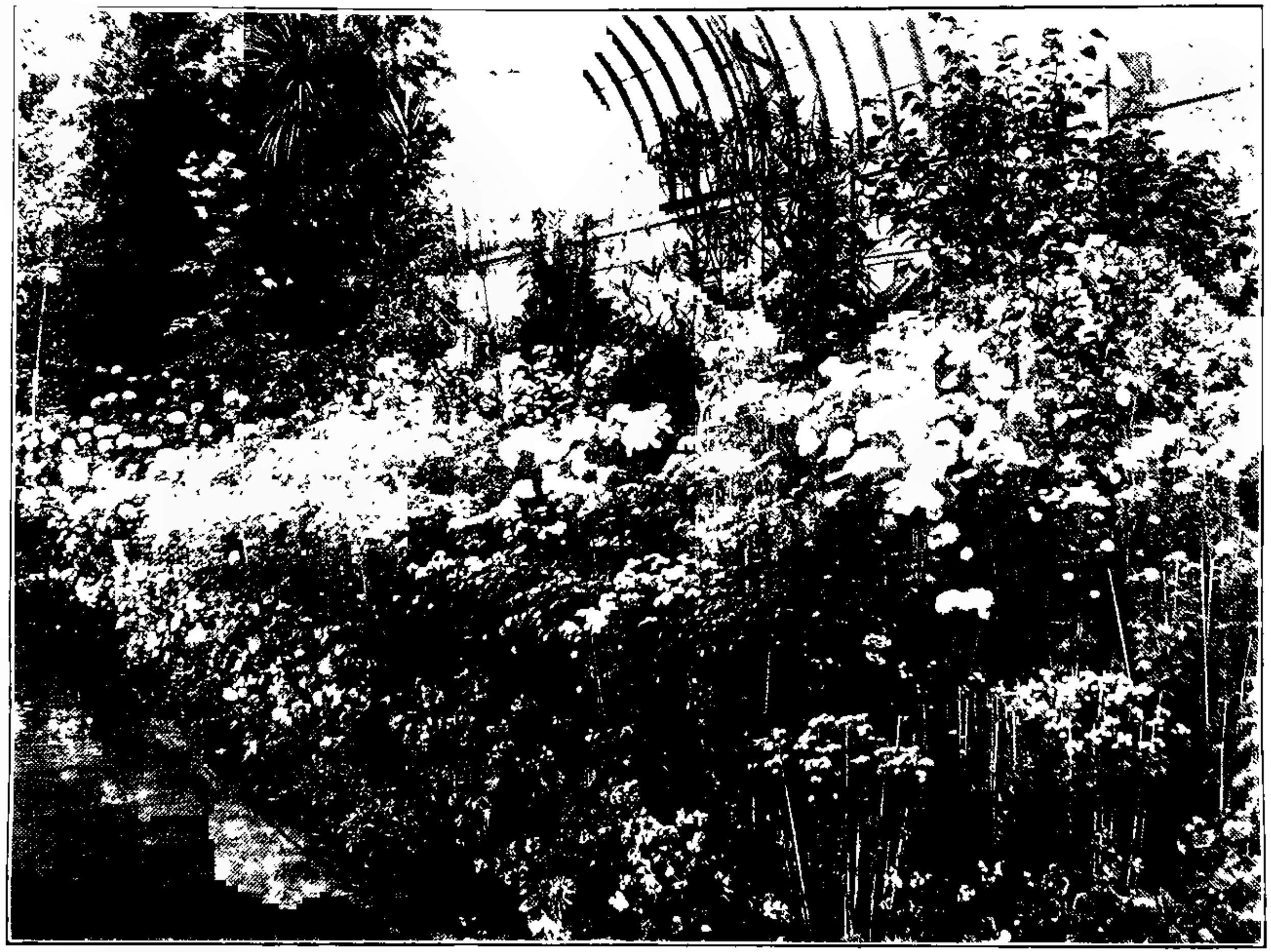

FIGURE 1. Collection of the smaller-flowered Chrysanthemums in the Central Display House of Conservatory Range 2 (photographed November 13, 1925). *Dahlia imperialis* (the "Tree Dahlia") is shown in flower in the background at the left

these feature varieties. All admired the anemone types, of such varieties as: Izola, amaranth; Sunshine, yellow; Pomona, white; Co-ed, with cream cushion and pink rays; and Maple Leaf, a combination of autumn colors. The very small pompons of the baby type, which were bred from the variety "Baby" itself, introduced in 1905 by Mr. Smith, are represented by Mary Pickford, pure white; Marguerite Clark, rose pink; Billie Burke, bronze; and Dorothy Gish, a white-flowered sort with hundreds of blooms only about ½ inch in diameter. These dainty graceful varieties are admirable flowering-pot plants. Anna, a white-rayed floriferous single, and Golden Mensa, the champion of the commercial yellow singles, are still the best of their group.

The use of tall plants of the large soft-textured pompons such as Muskoka, bronze, Angelo, pink, and Cometo, dark rose, gives more mass color in our displays than any grouping of the large exhibition blooms; these varieties suggest themselves as excellent for cut flowers in sprays, and for conservatory decoration. The Garden is desirous of obtaining more of these varieties, as well as baby pompons, single, and anemone types.

KENNETH R. BOYNTON.

FOREST RESOURCES OF THE NORTHWEST AND THEIR CONSERVATION[1]

Mankind is much dependent on wood. Though substitutes are being found for some of its uses, new uses are developing faster than substitutions. The chemical, physical, and mechanical properties of wood are such as to make it very useful to man, and the future of wood as a raw material is just beginning to dawn upon us.

We have already used up more than half of the original forest resources of the United States. The forests of the east, middle west, and south are much depleted; in many places practically exhausted. Five western states—Washington, Oregon, California, Idaho, and Montana now contain more than half of the standing commercial timber of the United States. The other

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, August 1, 1925.

half is scattered, more being in the south than in any other one region. The timber of the west is largely coniferous trees, such as the Douglas fir, pine, redwood, and hemlock, which furnish good general purpose lumber, and cedar, which is used for shingles and siding.

The country as a whole is looking to the west for its future supply of lumber.

The total annual rate of depletion of forests in the western states varies from one to three per cent. This depletion is mainly by cutting, though forest fires are always taking their toll. Often a tenth or more of the depletion is by forest fires.

Estimates on how long our timber in various parts of the west will last vary from 25 to 90 years. Probably 60 years is a good average. The pinch is sure to come in some places, however, in 20 years if the present rate of depletion is continued and the forests are not replaced.

The west is interested in forestry because its people wish a continuance of their prosperity and the United States as a whole is interested because it needs a lumber supply for the future years.

The ownership of the forests is partly private, partly national, partly state, and a small amount is owned by cities, where they own watersheds. All of these are now giving careful consideration to the future supply of lumber.

There are various possible ways of meeting the situation. Some of them are—stop forest fires, curtail the use of lumber, use inferior species, stop wasteful logging, stop export, reforest logged-off areas. It does not seem desirable to curtail the use of lumber to any considerable extent. The use of so-called inferior species such as alder and soft maple has already begun. Logging is not now done in such a wasteful way as it was a few years ago. The prosperity of the west would be interfered with if the export business were cut off.

Interest centers around reforestation, the prevention of forest fires, and the deferring of taxes on forest lands until the forests are ready to cut.

If we act vigorously and intelligently along these three lines, we can put our forests on the basis of a sustained yield, so that the future will be provided for without serious curtailment of

essential uses of lumber and without interference with such export as seems desirable.

The lecture was illustrated with over 40 slides, many of them colored, illustrating important lumber-producing trees, logging methods, forest products, and recreation in the forests.

GEORGE B. RIGG.

CARNIVOROUS PLANTS[1]

It is the rule in nature that plants derive their nourishment from non-living sources, while animals derive theirs directly or indirectly from plants. Occasionally, however, the tables are turned, for various plants have acquired the means of capturing small forms of animal life, and a few actually digest and absorb the animals.

There seem to have been two types of traps developed by plants quite independently. One may be characterized as cage-traps. The simplest form is found in the swollen, hollow leaf-bases of many plants, especially tropical ones, which form reservoirs in which rain-water accumulates, and in this water insects are drowned and decay. In the bladderworts, whole leaves or portions of leaves are modified in various ways into ingenious traps into which minute water animals find their way; their escape is cut off, and when they eventually die and decay, the resulting food-stuffs are absorbed by the plant. The same sort of traps are developed on a much larger scale by the different pitcher-plants of eastern North and South America, of California, and of the Orient.

The other type, in its simpler forms, comprises sticky areas on certain parts of various plants, which capture insects in the same way as fly-paper does. In our common sundews, after certain of the sticky hairs on a leaf have captured an insect, such as a fly, neighboring hairs of the same kind bend over the insect and hold it securely, while the entire leaf bends in upon it and does not again unroll until the insect has been thoroughly digested. The most astonishing development of this type is in the Venus'-

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, September 5, 1925.

fly-trap, in which the leaves have sensitive blades hinged in such a way that the two halves can fly together instantly, the mechanism resembling that of the artificial spring-traps used in capturing large animals.

The lecture was illustrated by lantern-slides and specimens.

JOHN HENDLEY BARNHART.

PROFESSOR CHANDLER

Professor Charles Frederick Chandler, who died in a Hartford hospital on August 25 last, in the eighty-ninth year of his age, was officially connected with The New York Botanical Garden, as one of its Scientific Directors, from its organization in 1895 until 1911, at which time his *ex-officio* membership ceased with his retirement as Professor of Chemistry in Columbia University. His interest in the Garden long antedated this period, as he was a member of the group that labored for many years to create an interest in its establishment. Although his scientific interest in botany was chiefly in its relations with organic chemistry, Professor Chandler was an enthusiastic lover of plants, both wild and cultivated, and he took a lively interest in the planting of our grounds. Even to botanists, however, Professor Chandler will be remembered better as a chemist, in which subject his taste ran more in the direction of economics than in that of pure science. His contributions in this field have done much to increase the comfort and safety of civilized life. As one-time Commissioner of Health of New York City, he was able to enforce the sanitary measures of which he was himself the discoverer in his capacity as chemist, accomplishing this sometimes in the face of great opposition and at considerable personal risk.

Speaking of his work in connection with the Department of Health, the *Journal of Industrial and Engineering Chemistry* says:

"He first took up Croton water, which was getting the blame for all sorts of diseases that could not otherwise be explained. He found it to be of fine quality, that no better water was furnished to any city. Then he examined the milk supply, and after long and bitter political struggle he established proper guarantees of pure products. Kerosene lamp explosions were frequent; the

first year he took up his work in this Department, fifty-two persons, mostly women and children, were burned to death from this cause. He established, again after a battle royal, the present standards of illuminating oil. In 1873 he was appointed President of the Board of Health and for ten years he held the office. He stopped the building of unsanitary tenements and put through the first tenement-house legislation. Sewer gas was a bugaboo among physicians and he proved this to be an illusion, but he set about to improve plumbing, which was very defective. He designed the method, still in vogue, for keeping water seals tight, and he proposed the now universally used flush closet. He made lasting contributions to the sulphuric acid industry and to the distillation, standardization, and use of petroleum. He discovered and passed on the ingenious system of ton-weight assaying, which is a boon to the metal and metallurgical industries. He was the father of modern sanitation. Indeed, his contributions are so many and so various, that one is in danger of 'missing the trees for the woods.'"

Of New England birth and English ancestry, Professor Chandler was educated at Harvard, and afterward, took his doctorate degree at Göttingen. Honorary degrees were conferred upon him by a number of universities.

He began his career as a teacher at Union College in 1857, and may be said to have continued it until the time of his death, since he remained an emeritus member of the faculties in which he had been actively engaged. He had much to do with the establishment of the School of Mines. Although not one of the founders of the New York College of Pharmacy, he was one of its early teachers and friends, and was actively engaged as a member of its faculty for forty-four years. For many years he served as Professor of Chemistry in the College of Physicians and Surgeons. In his relations as a teacher, he was closely associated with some of the best-known botanists of their times, including, among those who are gone, Professors Newberry and Underwood at Columbia, and Torrey, Holton, Wood, Thurber, and Schrenk at the College of Pharmacy, and it is delightful to know that, by every one of these men, he was beloved as a personal friend.

Professor Chandler was active in the founding of the American Chemical Society and was twice its president, besides serving as president of the Society of Chemical Industry.

However much we may admire the accomplishments and value the work of Professor Chandler as chemist and sanitarian, it is his personal qualities that will be best and longest remembered by those who were in close association with him. Generous in nature, cheerful in disposition, and optimistic in view, his society was a rebuke to pessimism and the best of cures for depression of spirit. It was these personal qualities, as much as anything, that made him a strong advocate and a successful worker in any cause that he espoused. His influence over students was quite remarkable. He carried them with him rather than lectured at them, and only a vicious or very negligent student could fail to participate in the teacher's interest in the subject discussed. There are few, if any, American professors, living or dead, who have so strongly influenced so many lives during their career as university students.

H. H. Rusby.

"BOB WHITE"

During the longest days of last June the call of "Bob White" rang out near the Rock Garden, recalling the early days when meadow-larks and bobolinks might be seen and heard on the hill between the Museum and Conservatory Range 1, where they nested in The New York Botanical Garden. Search was made to try and locate the nest, so as to leave the grass uncut around it for protection, but no trace of it could be found in any of the usual places. When haying began, it was discovered at the foot of a pine tree in the Pinetum near one of the main paths of the flower gardens. In order to protect it from visitors, several loads of new cow-manure were scattered around the trees and special efforts were made to exterminate all stray cats in the Garden. The eggs hatched out on July 15th and seventeen wee chicks, running like mice, were conducted down the hill across the path and into the shelter of the shrubs and plants. Cracked corn, rape, and hemp-seed were placed in several places and a bird-bath in the memorial garden was visited for water, so that they remained here until they were quite full-grown. They have been seen almost every day since around that part of the grounds but in diminishing numbers. The last flock seen contained ten and they

flew or ran across the path in the usual way, the mother sitting on the rail and calling until they all got safely across. It is likely that part of the brood crossed one of the main traveled roads, for they were seen in the Hemlock Grove and have never rejoined the rest of the covey. We hope that by continuing to feed them and getting rid of all cats and dogs running loose in the garden, we may be able to keep them and have them with us another year. The empty egg-shells were remarkably uniform, with a circumscissile break around the broad end of the shell, which is so dense that the lid remained attached by the inner membrance. They have been deposited with the American Museum of Natural History, and a note was sent to *Bird Lore*.

One windy night the mother quail got into House 4 of the conservatory and tried to call the young ones to come into a warm shelter. She was put out the next day, as the steam pipes were dangerous and likely to burn her feet.

Up to the present time (November 24th) eight of them still continue to feed, both night and morning, from the box hidden among the bushes, but during the day make their way down to the waste and weedy portions of the grounds of Fordham University, stopping on their way to visit the guard at the Elevated R. R. entrance, who feeds them bread and other tid-bits. At night they return to the feeding box and may be seen at sunset crossing the paths with necks outstretched or flying across to their roosting place among the densest plantations of evergreens.

ELIZABETH G. BRITTON.

BEQUEST OF HELEN C. INSLEE

The Garden received in August, 1925, the sum of $5,000 from the executors of the estate of the late Mrs. Helen C. Inslee, bequeathed by her without conditions. Mrs. Inslee was an annual member for several years prior to her death in 1909; the legacy has been subject to the life interest of her sister, Jennette Robertson, since that time.

At a meeting of the Executive Committee of the Board of Managers on November 17th, 1925, the bequest was appropriated for the construction of the driveway and path entrance just west of the Linnaean Bridge on the Pelham Parkway. Plans for this

entrance, drawn by Mr. John R. Brinley, Landscape Engineer, were approved in 1924 by the Board of Managers and by the Municipal Art Commission, and the work may be carried out in the spring of 1926 and will form a much-needed improvement. It is also planned to complete the boundary wall and fence near this entrance, about 200 feet of fencing being required there.

In the use of this bequest for a permanent entrance, former procedure has been followed. The Horticultural Garden path entrance on the Southern Boulevard and some of the fence adjoining it were built in 1920 by the expenditure of a bequest by Mrs. Mary J. Kingsland; the driveway and path entrance on Pelham Parkway at the lilac garden east of the Bronx River were built in 1921 through a bequest by Mrs. Louisa Combe, and the path entrance on Pelham Parkway a few hundred feet west of the Bronx River was constructed in 1922 by means of a bequest of Mrs. Emma Chambers Jones.

N. L. BRITTON,
Secretary.

CONFERENCE NOTES FOR NOVEMBER

The first conference for the autumn of the Scientific Staff and Registered Students of The New York Botanical Garden was held in the Museum Building on the afternoon of November 4th.

Dr. Arthur Hollick described the results attained from an examination of plant remains found forty-five feet below tide level in an excavation in lower Manhattan Island. The remains were in the form of fine lignitic débris and partially lignitized wood. Included in the finer material were numerous fragments of *Equisetum* stems, closely resembling *E. hyemale*. Sections cut from a log of considerable size showed the wood to be coniferous and subsequent critical examination proved it to be *Juniperus* and probably *J. communis*. The material probably represents an old interglacial swamp deposit, formed from the vegetation that grew there when the land stood at least fifty feet higher than it now does in that locality.

Dr. Hollick also exhibited and described specimens of wood and walnuts found sixty feet below the surface in an excavation made for a dam on the Guajataca River, Porto Rico. The speci-

mens are all partially lignitized. The nuts appear to be similar in general appearance to both *Juglans jamaicensis,* native in Porto Rico and Hispaniola, and *J. insularis,* native in Cuba. They are intermediate in size between those of the two species mentioned. From published reports upon the geology of the region, and from information otherwise obtained, it was inferred that the geological age of the deposit was quite recent, either late Pliocene or Pleistocene. The wood was not identified, except as that of an angiosperm.

Each lot of material will be fully described and discussed in articles soon to be published.

Mr. R. S. Williams reported on " A Collection of Mosses from Colombia." The following is a summary of his remarks:

Dr. F. W. Pennell and Mr. E. P. Killip spent some five months in 1922 in making collections of plants in Colombia. Their attention was given chiefly to the higher orders, yet somewhat over one hundred species of true mosses were obtained at altitudes ranging from near sea-level up to about 12,000 feet, on Mt. Purace. This moutain is a volcanic peak some 15,500 feet elevation. It is situated in the middle one of the three ranges that run through the interior of Colombia more or less parallel to the Pacific Coast and is about two hundred miles southwest of Bogota, and 2 and ½ degrees north of the Equator. Five or six species of the collection seem to be undescribed. One belongs to the large family Bryaceae, which includes 16 genera, the genus *Bryum* alone containing 800 species and two other related genera, *Webera* and *Brachymenium* about 250 species more. The moss under consideration seems distinct from any described genus and may be called *Neobryum costatum,* differing chiefly in its peculiar peristome. Another moss first collected in Chile by Lechler and incorrectly named *Campylopus penicillatus* seems not to have been collected since until a few stems were found mixed in with an undescribed species collected by Killip. It is a sterile plant but has dense clusters of more or less leaf-like hairs at the apex of the stems, that readily fall off and doubtless serve to propagate the plant.

Four sets of these mosses have been made. One set remaining with the Botanical Garden, the others going to the Academy of

Natural Sciences, Philadelphia, the Gray Herbarium, and the U. S. National Museum, all of the above institutions having aided in outfitting the expedition.

A. B. STOUT,
Secretary of the Conference.

NOTES, NEWS, AND COMMENT

The library of the Garden has recently come into possession of a large collection of books, periodicals, and pamphlets, the gift of Dr. F. H. Blodgett.

Among the visitors to the library during the autumn were the following botanists: Miss I. W. Anderson, Gray Herbarium, Cambridge, Mass.; Prof. H. H. Whetzel and Mr. S. H. Burnham, Ithaca, N. Y.; Prof. M. A. Chrysler, New Brunswick, N. J.; Profs. L. O. Overholts, James P. Kelley, and Mr. Lloyd T. Denniston, State College, Penn.; Prof. A. S. Hitchcock, Dr. W. H. Tisdale, and Messrs. Dr. W. A. Orton, Paul C. Standley, Emory C. Leonard, and W. W. Eggleston, Washington, D. C.; Dr. Roland M. Harper, Tallahassee, Fla.; Prof. J. C. Arthur, Lafayette, Ind.; Prof. C. J. Chamberlain, Chicago, Ill.; Prof. Douglas H. Campbell, Stanford Univ., Cal.; Prof. F. O. Bower, Ripon, Eng.; Prof. J. Burtt Davy, Univ. of Oxford, Eng.; Prof. George Voronoff, Leningrad, Russia; Prof. Tooasaburo Susa, Hokkaido Imperial Univ., Japan; Prof. Ichiro Ohga, Dairen, Manchuria.

Meteorology for November. The total precipitation for the month was 3.76 inches, traces of which fell as snow. The maximum temperatures recorded for each week were *66.5° on the 6th,* 64° on the 13th, 58° on the 22nd, and 54° on the 27th. The minimum temperatures were 29.5° on the 5th, 28° on the 10th, 32° on the 18th, and *23° on the 26th.* On the morning of the 30th the middle lake was seen covered with ice for the first time this autumn.

Meteorology for December. The total precipitation for the month was 4.03 inches, of which 0.05 inch (one-half inch by snow measurement), fell as snow in the night preceding the 16th. On

several other days there were slight traces of snow. The maximum temperatures recorded for each week were *58° on the 5th and 6th,* 53° on the 7th, 46° on the 19th, and 45.5° on the 22nd. The minimum temperatures were 32° on the 1st, 22° on the 10th, 24° on the 19th and *7.5° on the 27th.*

Meteorology for the year 1925. The total precipitation for the year at The New York Botanical Garden was 44.38 inches. This was distributed by months as follows: January, 3.35 inches, including 24.5 inches snow measurement (2.45 inches water); February, 2.69 inches, including traces of snow; March, 4.30 inches, including traces of snow; April, 1.92 inches, including a few flakes of snow; May, 3.49 inches; June, 2.98 inches; July, 7.89 inches; August, 1.94 inches; September, 3.37 inches; October, 4.66 inches, including one-fifth inch of snow; November, 3.76 inches, including traces of snow; December, 4.03 inches, including one-half inch of snow. The total snowfall for the year was 25.2 inches, which is figured as equal to 2.52 inches of rainfall.

The maximum temperature for the year was 101.5° on the 5th of June. The minimum temperature was — 3.5° on the 28th of January. The first hard killing frost of the autumn occurred on the morning of the 29th of October, when a temperature of 28° was recorded. The latest freezing temperature of the spring was on the morning of the 21st of April, when 29° was recorded.

ACCESSIONS

Museums and Herbarium

107 specimens of flowering plants from Ecuador. (Collected by Professor A. S. Hitchcock.)

6 specimens of flowering plants from Alabama. (Given by Dr. R. M. Harper.)

13 specimens of Hawaiian Islands plants. (By exchange with the California Academy of Sciences.)

2 specimens of flowering plants from Arkansas. (Given by Professor J. T. Buchholz.)

1 specimen of *Brassia longissima* from Panama. (Given by Professor R. A. Harper.)

93 specimens of flowering plants from South America. (By exchange with the United States National Museum.)

1 specimen of *Ibidium* from North Carolina. (Given by Mr. A. T. Beals.)

385 specimens of flowering plants from lower California. (By exchange with the California Academy of Sciences.)

2 specimens of *Penstemon.* (Given by Mr. Willard N. Clute.)

3 specimens of *Epilobium* from Washington. (Given by Mr. W. N. Suksdorf.)

8 specimens of flowering plants from Idaho. (Given by Mrs. M E. Soth.)

1 specimen of *Potentilla* from Quebec. (By exchange with the Victoria Memorial Museum of Canada.)

23 specimens of flowering plants from Oregon. (By exchange with Professor R. H. Dixon.)

387 specimens of flowering plants from Minnesota. (By exchange with the University of Minnesota.)

6 specimens of flowering plants from Colorado. (Given by Mr. George E. Osterhout)

90 specimens of flowering plants from Alaska. (By exchange with Mrs. John W. Chapman.)

1 specimen of *Tricholaena rosea* from Jamaica. (Given by Mr. H. H. Cousins.)

3 specimens of flowering plants from Chenango County, New York. (Given by Dr. H. M. Denslow.)

21 specimens of flowering plants from the local flora region. (Given by Dr. Arthur Hollick.)

1017 specimens of flowering plants from North America. (By exchange with the United States National Museum.)

155 specimens of flowering plants from Venezuela. (Collected by Mr. Henri Pittier.)

80 specimens of orchids from plants cultivated at Kew. (By exchange with the Royal Botanic Gardens, Kew, England.)

215 specimens of flowering plants from Salvador. (Collected by Dr. Salvador Calderón.)

10 specimens of fungi from Florida. (By exchange with Professor F. L. Stevens.)

1 specimen of *Cronartium Harknessii* from The New York Botanical Garden. (Collected by Mr. John Finley.)

1 co-type specimen of *Fusicladium photinicola.* (Given by Mr. R. L. McClain.)

2 specimens of fungi from New York. (By exchange with Dr. L. O. Overholts.)

1 specimen of fungus from New York. (Collected by Dr. Fred J. Seaver.)

1 specimen of *Chromocrea gelatinosa.* (Collected by Dr. Fred J. Seaver.)

1 specimen of *Sarcoscypha occidentalis.* (Collected by Dr. Fred J. Seaver.)

1 specimen of *Hypocrea citrina* from Ohio. (By exchange with Professor Bruce Fink.)

1 specimen of *Lachnea melaloma* from Pennsylvania. (By exchange with Dr. L. O. Overholts.)

1 specimen of *Humaria* from Washington. (By exchange with Professor T. C. Frye.)

1 specimen of *Gymnosporangium Juniperi virginianae* from Connecticut. (Collected by Dr. N. L. Britton.)

1 specimen of *Omphalia companella* from Vermont. (Collected by Dr. M. A. Howe.)

1 specimen of *Tapesia* from New York. (By exchange with Professor H. H. Whetzel.)

1 specimen of *Aleuria aurantia* from The New York Botanical Garden. (Collected by Mrs. N. L. Britton.)

1 specimen of *Nectria cinnabarina* from The New York Botanical Garden. (Collected by Dr. Fred J. Seaver.)

1 photograph of a specimen of *Mimusops amazonica.* (By exchange with the United States National Museum.)

11 specimens of *Mimulus* from North America. (By exchange with the Missouri Botanical Garden.)

2 specimens of forest trees from Bluefields, Nicaragua. (Given by Mr. C. D. Mell.)

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25 specimens, "Lichenes Exsiccati," fasc. 2. (Distributed by Mr. G. K. Merrill.)

3 specimens of orchids from Hawaii. (Given by Dr. H. M. Denslow.)

13 specimens of flowering plants from North America—type material. (By exchange with the United States National Museum.)

100 specimens, "North America Grasses." (By exchange with the United States Department of Agriculture.)

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ACCESSIONS

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A DWARF PLANTATION

To illustrate the phenomenon of dwarfing in trees and shrubs, a collection has recently been planted at The New York Botanical Garden, just east of the rock garden, near the entrance on the Southern Boulevard. The plants used for this demonstration have been moved from other plantations of the Garden, twenty-four kinds having been thus assembled. Other kinds are known in botany and horticulture, and the collection will be increased from time to time; but enough have been brought together to effect an interesting educational feature. Many other specimens may be seen in other plantations in the Garden, in proximity to normal trees of the same kinds.

Dwarfing, technically known as nanism, is known in many kinds of plants, not alone in trees and shrubs, but in herbaceous plants as well, being taken advantage of in agriculture in dwarf beans, peas, and other crops. The cause or causes of natural nanism are obscure. Some dwarfs have appeared in gardens and nurseries as what the gardeners know as sports and the botanists as mutants, coming from seeds among normal plants of the same kinds or from shoots, and have been perpetuated by cuttings, or in some cases by their own seeds. Other dwarfs have appeared under truly natural conditions, apparently also as sports or mutants. There are some actual records of such appearances.

Induced dwarfs, produced by starving, pinching, and twisting young plants and by pruning, are in a category by themselves and are not here taken under consideration. In some cases, at least, natural dwarfs have apparently been utilized in this process, brought to its greatest development by the skill and patience of

Japanese gardeners. Dwarfs must also be distinguished from species which are naturally small or low of growth.

The kinds of dwarfs used in the primary installation of the demonstration plantation here described are as follows:

1. *Dwarf Weeping Hemlock Spruce.*—A low form of the North American Hemlock Spruce, not over 5 feet high, but often 10 feet in diameter or more, with branches drooping quite to the ground. Its cones and leaves are quite the same as those of the normal forest tree which forms the famous Hemlock Forest of the Garden. This dwarf is believed to have originated in nature, many years ago, and is now widely planted for ornament and interest. Seed taken from one of the Garden trees, some years ago, germinated and produced plants which retained the dwarf drooping habit.

2. *Dwarf Catalpa.*—A small round-topped tree, becoming 8 to 10 feet in height, densely leafy. This has long been in cultivation and its origin is not definitely known, but it is understood to have come from the forest tree *Catalpa* of the eastern United States. The Garden's trees were presented by the late Mrs. F. K. Sturgis in 1912, and there is a group of them near the entrance to the Bronx River Parkway, close to many normal Catalpa trees, but none of the dwarfs have as yet flowered.

3. *Dwarf Round Arbor Vitae.*—A low compact dense nearly globular form of the American Arbor Vitae, or White Cedar. Our plants, which are about 2 feet in diameter, were presented by Bobbink & Atkins in 1917. One of them is making cones this year and if seed can be had we will try to germinate it and ascertain if this dwarf form may be thus perpetuated.

4. *Spaeth's Dwarf Arbor Vitae.*—The collection contains two plants of this remarkable dwarf, which were presented to the Garden by the late Lowell M. Palmer in 1904, under this name, and they seem to agree with the descriptions of it in horticultural literature, but it is one of the most curious of all dwarf evergreens, having two kinds of branches and two kinds of leaves, looking not at all like a normal Arbor Vitae. It is said to have originated from seed in a German nursery and was named for a man by the name of Spaeth, horticulturist and forester. We wish very much that this would produce fruit so that we could make sure that it is what it is supposed to be.

5. *Dwarf White Pine.*—A form of the most valuable of North American forest trees, given by Bobbink & Atkins in 1914, now only 4 feet high, with leaves shorter than those of the normal tree, which may be seen in the Pinetum near by.

6. *Dwarf Mountain Rhododendron.*—A low compact form of *Rhododendron catawbiense,* obtained by H. P Kelsey in 1921 in the mountains of North Carolina and believed to be a natural dwarf. This has made slow growth and is scarcely higher now than when we received it, but it has flowered.

7. *Knee Pine.*—This is a variety of the Mountain Pine of Central Europe and has long been in cultivation. It does not reach more than about 4 feet in height, the normal tree becoming 40 feet high. Our plants have as yet made no cones.

8. *Silvery English Yew.*—This becomes 5 or 6 feet high, but is widely spreading and may become 15 or 20 feet across. The normal European Yew attains the height of a forest tree. Our plants came from Mr. Lowell M. Palmer in 1908.

9. *Low English Yew.*—Our plants are about 3 feet high and 5 feet across, also from the Palmer collection.

10. *Golden Dwarf English Yew.*—An extremely depressed type, with relatively short leaves, recorded as originating as a seedling in an English nursery in 1838.

11. *Dwarf Cranberry Bush.*—A dwarf of the European *Viburnum Opulus,* densely branched and small-leaved. Our plants are over 30 years old, but only about 2½ feet high. We do not know the flowers or the fruit of this dwarf.

12. *Maxwell's Norway Spruce.*—A compact dwarf spruce about 2 feet high and somewhat broader than high; from the Palmer collection in 1904. Its leaves are shorter than those of the normal tree which in Europe becomes 150 feet high, and of which trees about 25 feet high may be seen in the Garden Pinetum in a group planted near the Railway Station.

13. *Gregory's Norway Spruce.*—This is a dwarf spruce somewhat similar to the one just described, but rather more compact and rounded, with grayish leaves, from the Palmer collection in 1903.

14. *Tamarix Savin.*—An almost creeping irregularly branched dwarf, believed to have been derived from the European *Juniperus Sabina.*

15. *Dwarf Japanese Red Pine.*—This is a compact round-headed condition of the Japanese Red Pine, our trees having become 12 to 15 feet high after 30 years' growth. The normal tree reaches 100 feet in height in Japan. Some of our trees have made cones and we will experiment with the seeds, if they mature.

16. *Weeping Japanese Red Pine.*—This is a contorted dwarf weeping type which came to the Garden from Mr. Lowell M. Palmer in 1903, and is still less than a foot high.

17. *Dwarf Japanese Yew.*—A nearly flat-topped variety of the Japanese Yew, becoming about 5 feet high, though some of our plants are not over 4 feet high. One tree of this variety has been used in the dwarf plantation, but the most noteworthy one in the Garden collection is with the other yews, on the ridge north of the Herbaceous Garden; this remarkable individual has attained a diameter over all of about 30 feet. The normal Japanese Yew, which forms a forest tree, may be seen along side of it.

18. *Dwarf Chinese Juniper.*—This was given to the Garden in 1917 by the firm of Bobbink & Atkins and has now reached the height of about 3 feet, and is rather loosely branched. Trees of the normal type 25 feet high may be seen in the Pinetum.

19. *Globose Chinese Juniper.*—Somewhat similar to the Dwarf Chinese Juniper and about the same height, given by Mr. Henry Hicks in 1917. The origin of this and of the Dwarf Chinese Juniper is unrecorded.

20. *Pfitzer's Chinese Juniper.*—This has long been in cultivation and is recorded as having originated in a German nursery many years ago. It is taller and more loosely branched than either of the two preceding types described and forms highly characteristic bushes.

21. *Plumose Sawara Cypress.*—A compact bushy evergreen, with small and scale-like leaves; our plants were given by Bobbink & Atkins in 1914 and are now about 4½ feet high. The species is native of eastern Asia and normal trees about 25 feet high may be seen in the Pinetum.

22. *Dwarf Hinoki Cypress.*—This is of Japanese origin, also given by Bobbink & Atkins in 1914 and now about 6 feet high. In Japan the normal tree reaches forest size.

23. *Pigmy Hinoki Cypress.*—This is a dense dark green dwarf now about 2 feet high, which came to us from the Palmer collection in 1903.

24. *Dwarf Box.*—This has long been known and is esteemed for forming borders along garden paths, reaching a height of scarcely over a foot. It presumably originated in Europe, but whether in nature or in some garden or nursery is not definitely known.

We shall be glad to receive dwarfs of other kinds to add to this plantation. Enough have been brought together, however, to indicate something of the range of nanism in the vegetable kingdom in North America, Europe, and Asia.

N. L. Britton.

THE ORIGIN AND HISTORY OF SOILS[1]

The lecturer prefaced his lecture by remarking that the subject of soils was one in which both geology and botany are intimately involved, and that a knowledge of the structure and composition of rocks, as well as of the structure and life-history of plants is essential for a thorough knowledge of the origin, history, and general characters of soils. It is a case of cause and effect. Geology may be regarded as representing the cause and botany as representing the effect, for the reason that soil must first be formed by geological processes before plant life is possible.

The average person, if asked to define soil, would probably reply "Soil? Why, soil is loose earth," or something to that effect; and that would be a sufficient definition for all practical purposes, unless some particular kind of soil was in question. The Standard Dictionary defines soil as "finely divided rock material, mixed with decayed vegetable or animal matter, constituting that portion of the surface of the earth in which plants grow or may grow." From the viewpoint of exact science, however, soil may be defined as disintegrated rock, *or* decayed organic matter, or a mixture of both; and it may or may not be capable of supporting plant life. It may be composed entirely of mineral matter, such as a fresh area of beach or dune sand, or volcanic ash; or it may consist entirely of vegetable matter, such as a

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, October 31, 1925.

bed of peat or layer of leaf mould; or it may be a mixture of mineral, vegetable, and animal matter, such as the ordinary soils of farms and gardens. All soils, however, hark back primarily to a purely mineral or inorganic origin—to the disintegration of the original hard rock crust of the primitive earth, by chemical and mechanical agencies. These primitive conditions, however, will never prevail again and need not concern us further.

The origin and formation of soil, under conditions that prevail to-day, may be observed and studied almost everywhere. There are very few places in which soil of some sort is not in process of formation. Even upon the roofs of our tallest city buildings there is a constant fall of atmospheric dust, soot, fine ashes, etc., that, in the aggregate, represents many tons of soil deposited each year.

Soil may be either native, that is, formed in the locality where it is found, or it may have originated elsewhere and was transported by natural agencies to its present location. Native soil—soil formed "in place," as it is usually designated—necessarily consists only of elements that were constituents of the underlying parent rock from which it was derived. Transported soil, however, may contain constituents very different from any that are in the rock upon which it rests. Soil that is formed in place is due to the fracturing and subsequent mechanical and chemical disintegration of the underlying parent rock. Rain, frost, sunshine—each plays its part in the process—and then vegetation becomes established and contributes its quota. Some kinds of plants can get along and flourish with surprisingly little soil in which to maintain their growth. Lichens, for example, are partly fungoid and partly algoid in their composition. They grow very often upon what appears to be bare, smooth rock surfaces. But their tiny rootlets are insinuated into the inequalities, and, once established, they begin the process of rock distintegration. The mechanical effects that they produce are infinitesimal and the chemical effects are but little more so. If we lift up or scrape away a growth of lichen from a rock the surface beneath may be seen to be roughened and a thin layer or film of soil, usually more or less black from the decayed parts of the lichen, may be seen. This is one of the simplest examples of the formation of soil in place and although the amount so produced is

almost negligible it is of interest because it probably represents the origin of the first terrestrial plant-bearing soil. Lichens can exist on hot, sunbaked rocks under conditions in which any other form of vegetation would be impossible. Hence we may assume that when the original crust of the earth had cooled sufficiently for the first terrestrial vegetation to establish itself the lichens or lichenoid algae represented the first kind of vegetation to emerge from the adjacent waters and adapt itself to, and assist in forming, the primitive terrestrial soil.

Many of the higher plants also require but little soil to maintain their existence. The sedums or stone-crops and the *Opuntia* or common cactus of this vicinity are familiar examples in this connection, and they follow the lichens closely as primal agents of rock disintegration. They usually take possession of cracks, crevices, or joints in rocks, which are thus slowly eaten into and widened and become receptacles for soil, until enough has been formed to harbor the seeds of shrubs and trees. As soon as these are able to germinate and maintain an existence, the disintegration of the rock is more rapid, due to the more vigorous root growth which frequently splits the rock asunder and hastens its disintegration and its decay into soil.

The effect of marine vegetation is simliar to that of terrestrial, as may be seen by an examination of rocks on the seashore, where they are covered with growths of seaweeds; but on the seashore the mechanical effect of wave action in wearing away the rocks is at a maximum, and the disintegrating effect of vegetation is incalculably small in comparison. The gravelly and sandy soil of beaches is due, to all intents and purposes, entirely to the disintegration and attrition wrought by water, ice, and wind.

Soils that are almost purely organic in their constituents are formed wherever vegetation decays and accumulates, as on the floor of a forest. This is what is commonly known as leaf-mold, and in the aggregate it forms no inconsiderable part of the Earth's surface-soil. Peat bogs are also examples of the formation of organic soil in place, and these often contain beds of peat many feet in thickness and extend over miles of territory.

Transported soil is due mostly to the action of running water, volcanic action, wind, or ice, usually in the form of glaciers. Rivers

transport vast quantities of sediment, often for hundreds of miles, and deposit it at their outlets where it forms bars and deltas. The deltas of the Nile and the Mississippi are too well known to require more than passing mention. They are hundreds of miles in extent and their soils represent the disintegrated rock from thousands of square miles of territory drained by the rivers and their tributary branches.

Volcanic activity was a far more extensive source of soil formation in the past than it has been in historic time; but a number of intermittently active volcanos (Etna, Vesuvius, Krakatoa, Katmai, and others), have contributed an enormous amount of ash and cinder soil to their respective vicinities.

Sand dunes represent the most striking example of transported soil due to wind action. The sand and fine gravel of sea and lake beaches is carried inland during high winds and is piled into drifts that in certain localities reach more than a hundred feet in height. It is a more or less difficult matter for vegetation to gain a foothold on a sand dune, as it is always shifting its position more or less, and the composition of the soil is usually such that only a limited number of plant species are suited to it. The region in the vicinity of Provincetown, at the end of Cape Cod, furnishes some of the most striking examples of the formation of sand dunes and the phenomena connected with them.

Ice-transported soil may be seen and studied in connection with any glacier that terminates on the land. Glaciers may be likened to slow-moving rivers of ice that are constantly traveling from high altitudes to lower ones. In the course of their travels they erode the rock surfaces over which they pass, and also accumulate fragments that fall on their surfaces. This material is pushed and carried forward and is finally dropped when the ice is melted at its place of furthest advance. This accumulation of material is known as the terminal moraine. Where it rests upon bed rock the line of demarkation is usually sharp and well defined, without any of the phenomena of gradual rock disintegration into surface soil. Glacier-transported soil and other phenomena of glacial action may be seen almost everywhere in the vicinity of New York, in connection with the morainal deposits of the great continental glacier that extended southward to this region during the geological period that we know as the

Quaternary or Ice Age. Practically all of the soil in this vicinity has come to us through glacial action from regions to the north; and if we examine the boulders and larger rock fragments of this soil we may recognize examples of most of the rock outcrops that occur between here and the Adirondack mountains or even the highlands of Canada.

The lecture was illustrated by means of lantern slides of lichens, trees, and other forms of vegetation growing on the surface and in the crevices of rocks; forest floor and peat bed accumulations of plant remains; rock disintegration and soil formation in place; and transported soil as exemplified by the ash and cinder deposits in the vicinity of Mt. Katmai, Alaska, and Mount Pelée, Martinique; the sand dunes of Cape Cod and exposures of the terminal moraine on Staten Island.

ARTHUR HOLLICK.

BOTANIZING IN THE HIGHER ALLEGHANY MOUNTAINS

II. WEST VIRGINIA AND TENNESSEE

In the first instalment of this paper, I gave an account of our botanical work in West Virginia, and mentioned our return to Staunton. Here we stopped at the Y. M. C. A., partly because there were no tourist camps near the city, and partly because Mr. Perry and myself thought that we needed a good hot bath. Our next intended field of exploration was the renowned Peaks of Otter. These mountains are most accessible from Bedford on the road between Roanoke and Lynchburg. As one of my former colleagues, Dr. Murrill, has his home in the latter place, I thought it would be pleasant to call on him. We decided to drive to Lynchburg by the way of Afton, rather than by Lexington, partly because the state road through the latter place was said to be under repair. We crossed the Blue Ridge just before we came to Afton, but did not stop for botanizing. The Ridge had a typical Alleghanian hardwood flora. Shortly after leaving Afton we found that the state road as far as Lovingston was under construction and we had to make a long detour on rather poor dirt roads. After some inquiry we located Dr. Murrill's tem-

porary dwelling place. He was the sole occupant of the home of his aunt, Mrs. Ford, who, on account of sickness, was staying with her daughter, the assistant directress of the Miller Orphanage for girls, in the suburbs of Lynchburg. The back veranda of the house was turned over to us as a work room, where we attended to the pressing of our specimens and packed boxes for shipment. We found lodging for two nights in the Y. M. C. A., and took a whole day off from the work. Dr. Murrill entertained us with music, partly of his own composition, set to poetry relating to flowers, birds, and nature study in general, intended for Boy Scout and Girl Scout camps, etc.

In the forenoon of June 30th, we left Lynchburg, passed through Bedford at noon and reached the high gap between the two Peaks of Otter early enough to make a good camp near a spring. On the following day we climbed "The Peak," *i.e.*, the most southern of the two mountains. The peaks, as well as some lower mountains north thereof, are now included in a U. S. Forest Reserve, except the very top of "The Peak," which still remains as private property. At the entrance of this, is a toll gate (50 cents admission), a log cabin containing a small lunchroom and a few bedrooms, further up two water-tanks, a log cabin shelter, where campers may spend the night, and wooden stairs to the top of the big boulders on the summit. An old wagon road, made when the houses were built, leads zigzag to the toll gate, but is not now used, as the supplies are now brought up on horseback. It can not be used for automobiles. A few steeper trails unite right before reaching the gate. The view from the top is superb.

"The Peak" is a very steep cone with an altitude of 3,875 feet. It is wooded to near the top which is covered with a few enormous bare boulders. The woods consist entirely of Alleghanian hardwoods, of which were noted hickories (*Hicoria glabra* and *H. ovata*), oaks (*Quercus maxima, Q. Primus*), basswood (*Tilia heterophylla*), maple (*Acer spicatum* and *A. nigrum*), chestnut (*Castanea dentata*), etc. The chestnuts on the peak were free from blight, but in the lower valleys of the Blue Ridge they were more or less infested and in some places wholly destroyed. At the foot of the boulders at the summit we found dogwood (*Cornus alternifolia*), rock maple (*Acer spicatum*), and chokeberry (*Aronia melanocarpa*). Among the undergrowth may be men-

tioned *Uvularia grandiflora, Hydrangea arborescens, Circaea lutetiana, Clintonia umbellata,* a species of *Asarum,* probably *A. canadense, Atragene americana, Ranunculus recurvatus, Aruncus alleghaniensis, Coreopsis stellata, Lilium Grayi, Scophularia leporella,* three species of *Monarda,* an unknown *Stachys, Convallaria majalis, Tithymalus paniculatus, Heuchera Curtisii, Galium latifolium, Thalictrum coriaceum, Veratrum parviflorum,* and enormous specimens of *Urticastrum divaricatum,* 3–4 feet high.

The following day, July 2, we made an attempt to climb the "Flat Top" the northern of the two peaks. "The Peak" has numerous visitors, not only tourists but also the native population, which often gathers there on the 4th of July and other occasions for picnics. There is a fairly large inn at the pass and a dance pavilion near where we camped. The "Flat Top" is seldom climbed even by the natives. We were told that there was an old trail to the top, used occasionally by the U. S. forest rangers and that it started near the "Big Spring." We missed the trail and got into a primeval forest of chestnuts, oaks, hickories, and basswood. The shade was so deep that there were no flowers to be found among the undergrowth. We got into such a tangle of blackberries, raspberries, Virginia creepers, etc., etc., that we became exhausted and gave up the climb as a "bad job," and retreated down the slope. When nearing the wagon road we crossed an abandoned field, where we found some weeds and introduced plants, such as two species of wild lettuce, a spurge (*Tithymalus paniculatus*), and milk-weed, (*Aclepias exaltata*), winter cress, (*Barbarea verna*), and a rare immigrant from the Old World, *Silene dichotoma,* growing in profusion. We spent an hour or two collecting along the road through the pass but found little of interest. As the day was very hot, in fact the hottest day we had during the summer, we returned to our camp rather early.

On July 3, we continued our journey, passing through Bedford, Roanoke, Pulaski, Wytheville, and Marion to Abingdon where we camped the second night. We had intended to visit White Top and Mt. Rogers, the two highest mountains in Virginia, near the North Carolina border, both about 5,500 feet high. As we wished to see the higher mountains of the latter state and Tennessee as

early in the summer as possible we left these mountains for the return journey, but I may just as well give the account of our visit here.

On our return trip nearly a month later, on July 29, we left the main state road at Chilhowie, turning southeast, taking the road for Konnarock. The road crosses the Iron Mountains. The inclines on both sides are very steep, but the road was as good as a mountain road could be expected to be. On the other side of Iron Mountain the road followed a branch of White Top River down through a most beautiful narrow dell, both sides being lined with primeval forest trees and the river-banks covered by rhododendrons (*R. maximum*). I recognized the place from my former trip to White Top, 18 years ago, when I traveled the road in an old rickety wagon, drawn by a white horse and an almost black mule. At that time the rhododendrons were in full bloom. I am not the only one that has recognized the beauty of the spot, for the present owner of the land, a lumber company, has decided to preserve the dell in its present shape. Eighteen years ago, the bottom of White Top River was all covered with old forest, which is now gone. Near the old crossing of the river, the main road now turned to the right, following the river to Konnarock, two miles below. I do not know if there was any settlement there at all eighteen years ago, as I was not so far down the river then. Now it is a thrifty place with a large saw mill, a good general store, a hotel, post-office and a high school, all the result of the operations of the lumber company and the wise management of the manager, Mr. Hessinger.

We stopped at the post-office and inquired where we could make camp. Somebody suggested that we cross the river into a piece of land set aside as a community ground with a pavilion, fire place, etc., among the rhododendrons. Here we camped.

The next morning, as the radiator was leaking, we did not dare to try to reach the top of White Top in our car, and decided to make the trip on foot. We inquired for the best trail up, as the wagon road would be at least five miles longer than a direct trail. Hearing this, Mr. Hessinger's second son offered to take us up in his old Franklin, which offer we accepted. The party consisted of young Mr. Hessinger, a cousin and an aunt of his, and ourselves. The two young men, both college students, accom-

panied us on our tramp on top of White Top, while the aunt stayed in the car.

The White Top reaches an altitude of 5,520 feet. The slopes are covered by hardwood forest, in the valleys mixed with pines. Near the top on the southwest side there is a large grass-covered space devoid of trees. This space is covered by a nearly pure stand of *Danthonia compressa.* In the fall when the grass is dry, this spot is light yellow and in winter white with snow, in great contrast to the dark green spruce-forest on the cap above. Hence the name White Top. The forest cap consists of red spruce. I did not see any balsam but the balsam (*Abies Fraseri*) is said to be found on the top of Mt. Rogers, a mountain north east of White Top and of about the same height. On Mt. Rogers and Pine Mountain, another neighboring mountain, Dr. and Mrs. Britton and Miss Vail in 1892 collected also *Picea australis* Small, a species related to the red spruce, but with less hairy and more slender twigs, more slender needles, and smaller cones. Perhaps those specimens collected by me on Panther Mountain and referred to as *Picea canadensis* in my former instalment may belong to this rather than to the white spruce. The latter has not been reported from any place in West Virginia, Virginia, or Pennsylvania. Northern New York seems to be the southern limit of said species. The upper part of White Top and especially the grass-covered part is used for horse pasture. On this account and as the summer had been exceedingly dry, our trip was almost a failure as far as herbarium specimens were concerned. The only specimens of real interest collected were *Cardamine Clematitis* and *Aster chlorolepis.*

The following morning young Mr. Hessinger and his cousin took us up a ridge halfway up the Iron Mountain, but it began to rain and we returned to Konnarock. After noon the sun began to shine and his car stopped opposite our camp. Mr. Hessinger had also joined the party. We drove up to the same place, where the car was parked. Mr. Hessinger led the way along a ridge. As we were ready to descend into the valley of the upper White Top River a sudden shower came down and soaked us thoroughly. In the valley we saw the most magnificent forests, which will be the field of operation of the sawmill next year. Only a few herbarium specimens were gathered.

At Abbington we were told that the road between Bluffs and Johnson City and between Bluffs and Elizabethstown was under repair and we were advised to go to Roan Mountain by way of Damascus, Va., Mountain City and Hampton, Tenn. Our informer had been as far as Mountain City and he said that the road was good. So far it was good, but at that place we were told that from there to Hampton the road could not be made by an auto and that none had gone that way for two or three years. We were told either to go back to Abbington or else cross over into North Carolina and go by Trade, Vilas, and Banners Elk. The mountain road was said to be fair at first and then bad for about 6 miles to the state line. To us the bad road seemed to be at least twice that long and indeed very bad and narrow. As soon as we entered North Carolina the road suddenly become twice as wide and excellent and remained so even after returning into Tennessee. We arrived at Roan Mountain station on July 5 and camped on the edge of the village. The following day we stayed in camp and attended to our pressing and mailed material to New York. On July 7th, we started for Roan Mountain, 14 miles away.

On our automobile map the road to the top was indicated as a "good dirt road," and it had been so until lately. Eighteen years ago when I visited the mountain it was a fairly good wagon road, leading up to the hotel at the summit. Fifty or even a hundred years ago it was a rather noted place, and visited by many of the older botanists, as Buckley, Curtis, Chickering, Carey, Gray, etc. On my former visit there were more than forty guests at the hotel, most of them, however, persons afflicted with hay-fever seeking relief in the high altitude. Some years ago the hotel was torn down, after having been damaged by a fire and the road fell into disuse. We drove to a sawmill near the foot of the mountain itself. The road was rather poor but passable. At the sawmill, a farmer, according to a previous agreement, waited for us with two horses, one for packing tent, blankets, and provisions for two days, the other a saddle horse on which we were to take turns. At the next to the last house on the road we found a mule which was to be taken up to the mountain pasture. Mr. Perry rode it most of the way and I used the horse up to the gap near the top and two miles from our camp. Not having been on horse-

back for fourteen years, I became so broken up that I could scarcely walk.

The flora of Roan Mountain is Alleghanian up to said gap. We did no collecting during the ascent. The forest consisted of oaks, hickories, yellow birch, maples, and chestnut; in the upper part, mostly maple and birch. We found a few trees of buckeye (probably *Aesculus octandra*) even near the gap (Carver's Gap) at an altitude of nearly 6,000 feet. Here one is met by a northerly extension of the grassland which covers the whole southern slope and in some places reaches the top of the ridge. This grassland was indeed poor picking ground for a botanist, as it is used as pastures for horses, mules, and sheep. At our visit it was exceedingly so, partly due to the exceptionally dry summer. At the gap the road turns west and passes north of the highest knoll and about 500 feet below the summit, which is 6,318 feet high and covered with evergreens, *i.e.*, red spruce and Fraser's balsam. On the southern side, this grove is bordered by a fringe of alders. The road ascends gradually till it reaches the most northwesterly part of the ridge, where the old hotel was situated. Here the ridge swings south and is mostly covered by rhododendrons (*R. catawbiense*). Here is found a field of this beautiful shrub, stretching about two miles in length and more than half a mile in width at some places. It must represent a gorgeous sight when the shrubs are in full bloom. We found only about half a dozen flower-clusters still remaining. The shrubs were a good deal taller than at my former visit and evidently had encroached on the grass field, but the flora was otherwise much poorer than in 1907. In the undergrowths we found among other plants, *Sieversia radiata, Houstonia serpyllifolia, H. montana, Arenaria glabra, Viola blanda, Dendrium Lyonii, Veronica serpyllifolia, Alsine graminea, Sibbaldiopsis tridentata,* etc. At the southern end of the rhododendron field is another knoll of spruce and balsam ending at the precipitous rock-ledges, forming a rim, from which in clear days the most magnificent view is seen of the Nolichucky Valley. In the spruce forest we found the mountain cranberry (*Hugeria erythrocarpa*). The plant is so unlike a cranberry that I can not understand why that name and why Dr. Gray and others classified the shrub among the species now known as *Oxycoccus.* Our stay on Roan Mountain was not pleasant on ac-

count of the cold wind, the fog, and drizzly rain that we encountered. We stayed only one night and made our descent the second afternoon, I walking down the mountain proper and riding only two miles to the sawmill, where our car was waiting. We returned to Roan Mountain station about eight P M.

P. A. RYDBERG.

ORIGINAL EXPLORATION OF THE YELLOWSTONE NATIONAL PARK[1]

Rumors of a geyser region in the Yellowstone, chiefly through the stories of hunters and trappers, had been attracting increasing attention. In 1871 a military reconnaissance into the region discovered that the rumors were based upon facts, and in 1872 the government sent the Hayden Geological Survey Expedition to study the region and report the results. In those days, the government sent expeditions to explore and map the unknown regions of our country. The Hayden Expedition included representatives of the various sciences, the purpose being to collect information not only as to the geography of the unknown region, but also its geology, mineralogy, zoology, and botany.

The main outfitting camp was at Ogden, Utah. After the organization of the exploring party, with its scientific corps, and the necessary addition of guides, packers, hunters, etc., the party started by pack train north toward the Yellowstone country, following hunters' trails when possible. They first entered the Teton country and spent some time in exploring and mapping it. Then they proceeded northward to discover the geysers. They knew the general direction, but were confused in following it. Many days were spent in traveling over very rough country without finding the geysers. Finally, trees were climbed daily, and at last, on the edge of the horizon, dense volumes of steam were seen rising, as if coming from some manufacturing city. A hard march brought the explorers into the midst of this steam, and the hot springs and geysers were discovered.

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, November 21, 1925.

Each scientific member of the party was assigned a geyser for study. His duty was to time the period of eruption and measure the height of eruption. It was also interesting to decide upon the names to be given to the various geysers. This work continued through most of the summer, with numerous side trips into the neighboring country. Especially impressive were Yellowstone Lake and Falls and the Grand Canyon, with its marvelous coloring. The artist of the expedition was Thomas Moran, whose wonderful painting of the Grand Canyon now hangs in the Capitol building at Washington.

In addition to the excitement of hot springs and geysers, the party had many experiences with the wild animals, which really congested the region. The Indians were afraid to enter it, and so the animals found it a park of safety for them.

The experiences and incidents of this summer of exploration would fill a volume, but the result was that the Yellowstone National Park was established and mapped, and is now a great center of tourist travel.

The speaker showed lantern slides illustrating the geysers, canyons, lakes, and characteristic plants of the Yellowstone National Park.

JOHN M. COULTER.

BOTANICAL FEATURES OF CEYLON[1]

The island of Ceylon consists of a central mass of mountains, surrounded by a rather narrow fringe of lowlands. The latter portion is chiefly in cultivation and the small remaining areas of wild land have also been greatly altered by cutting and burning. In the mountains as well, the lower slopes have been largely brought under cultivation. Rubber is grown extensively to an altitude of about 1,500 feet, above which it is replaced by enormous tea gardens covering the mountain sides to 5,000 feet, above which the land is reserved by the government for forests.

The great botanical garden of Ceylon is located at Peradeniya, at an altitude of about 1,500 feet, and has long been famous for

[1] Abstract of an illustrated lecture by Dr. H. A. Gleason, given in the Museum Building of The New York Botanical Garden on Saturday afternoon, November 28, 1925.

its beautiful and important displays and for its researches into various problems of tropical botany. It covers an area of 150 acres and the grounds have been developed for landscape effects, making it wonderfully attractive. There are spacious lawns, long vistas among the trees, gorgeous beds of flowering plants, and numerous specimen trees of great interest. Among the latter may be noted the huge tree of India rubber, the giant bamboos, the Kauri pines, the banyans, and the talipot palms. The latter bloom but once, usually when from forty to sixty years old, and then die. Their clusters of flowers project above the crown of leaves, are fifteen feet high and wide, and form a most magnificent display.

The mountains which tower above the botanical garden toward the east appear from a distance to be forested, but a closer view shows that they are covered with tea gardens and with sorts of economic trees, and it is not until the forest reserves are reached at 5,000 feet that really natural vegetation is encountered.

The forest on these high elevations is ordinarily known as a mossy forest, from the great development of mosses and epiphytes on the trunks and branches. Seen from across a valley, the crowns of the trees present a great range of shades and colors. Within the forest, the view is not so pleasing. The trees are seldom more than 30 feet high, with crooked gnarly trunks, while the floor of the forest is a tangle of many sorts of shrubs, among which a small bamboo and the erect Strobilanthus are most conspicuous. The latter is interesting from its habit of growth in dense patches, in which almost every individual blooms simultaneously and then dies, so that each patch is of uniform age and size. Periodic blooming of this type is known also for other plants, notably certain bamboos and orchids, and its cause is not yet fully understood.

The mossy forest covers all the mountains to their very summits. The highest peak is 8,300 feet, so that a true alpine vegetation is not developed.

A conspicuous feature of the higher mountains is the series of wide grassy plains, known as patanas, occupying many of the mountain valleys and extending a short distance up their slopes. The patanas are occupied almost completely by herbaceous plants, the only conspicuous exception being the isolated rhododendrons,

reaching a height of twenty to thirty feet. Whatever may have been the original cause for the development of patanas, their perpetuation is undoubtedly due to fire, which annually sweeps over them, doing no permanent injury to the herbs, but killing all seedling trees except a few of the rhododendrons. They seem remarkably resistant to fire, and the older trunks are almost invariably fire-scarred. If fires are prevented, as they are near some of the tea gardens, the rhododendrons multiply rapidly, soon cover the whole patana, and serve as shelters for many other species, so that the patana is soon completely reforested.

H. A. GLEASON.

NOTES, NEWS, AND COMMENT

Dr. and Mrs. N. L. Britton left New York for San Juan on January 21. They plan to devote two months or more to a continuation of their field studies of the flora of Porto Rico.

Dr. H. A. Gleason, Curator, sailed on January 14 for Porto Rico, where he will undertake an ecological survey of the island in collaboration with Dr. Mel. T. Cook, of the Insular Experiment Station, and under the joint auspices of The New York Botanical Garden and the Department of Agriculture of Porto Rico. It is planned to publish the results of the survey as a part of the Scientific Survey of Porto Rico, to which The New York Botanical Garden has already made notable contributions. The work of Dr. Gleason and Dr. Cook promises to be of unusual interest to ecological science, since comparatively little survey work has hitherto been attempted in the tropics.

As the outcome of a special hearing held in Washington in November, the Secretary of Agriculture, Hon. Wm. M. Jardine, announced on December 30 that the restrictions on the entry of Narcissus bulbs authorized by Secretary of Agriculture Wallace three years ago were to go into effect on January 1, 1926, as scheduled, without modification. In commenting on his action, the Secretary said that the information available in 1922 on the entry of pests on these bulbs undoubtedly justified fully the placing of the restrictions, and that the facts obtained since that time

have emphasized the menace to agriculture then indicated. However, the restrictions on the entry of eight other classes of bulbs transferred from the restricted to the free list in 1922 for a three-year period have been postponed by order of the Secretary to give more opportunity to determine the risk in connection with their entry. These eight classes, which may still be imported under special permit, are *Chionodoxa* (Glory of the Snow), *Galanthus* (Snowdrop), *Scilla* (Squill), *Fritillaria imperialis* (Crown Imperial), *Fritillaria meleagris* (Guineahen-flower), *Muscari* (Grape Hyacinth), *Eranthis* (Winter Aconite), and *Ixia.*

On Saturday afternoon, October 24, in the lecture hall of the Museum Building of The New York Botanical Garden, Professor H. H. Whetzel, of the Department of Plant Pathology, Cornell University, gave a talk on "Keeping Plants in the Gardens and Borders Healthy." Professor Whetzel has been interested for many years in the study of diseases of certain garden perennials, especially peonies. He has also studied the diseases of tulips. He said that the first thing to be kept in mind in keeping the plants of the garden and border clean is the necessity of observing certain sanitary practices. In the first place, no bulbs or plants should be put in the border or garden which show any evidences of diseases at the time they are being planted. All diseased plants and bulbs should be rigorously examined and discarded or if especially valuable should be put in a corner by themselves where they can be carefully watched during the growing season, and if disease appears they should be immediately destroyed. A careful watch should be kept of the plants and any which show diseases of any sort should be brought to the attention of a competent plant pathologist for suggestions as to what to do in the particular case. Plants which evidently are dying from disease should be promptly removed and destroyed. In the autumn as soon as the blooming season is over all tops of herbaceous perennials and annuals should be promptly removed and burned before mulching the beds for the winter. Such measures will go far to keep the plants during succeeding years free of disease. During the growing season the plants should be frequently sprayed, or better, dusted with some copper spray or dust mixture. Dusting has many advantages in that the plants are not dis-

colored by the mixture as they are when bordeaux is used as a spray. It is also more convenient and rapid. It is quite as effective. Sanders' copper lime dust is most satisfactory for general dusting. However sulphur dust is more effective for certain leaf spots and mildews. Nicotine dust should be kept on hand to apply when plants show sucking insects such as aphids and a spray or dust of some arsenical such as arsenate of lead should be used for insects that eat the foliage. Since most diseases of plants require special consideration the grower should keep in touch with some plant pathologist who can advise him regarding the different cases as they come up. The lecturer spoke without lantern slides but illustrated his talk with blackboard sketches.

ACCESSIONS

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MUSA IN TROPICAL AMERICA

HARVEY BASSLER

SEEDS AS CARRIERS OF DISEASE

C. R. ORTON

TREES AND SHRUBS IN WINTER

PERCY WILSON

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NOTES, NEWS, AND COMMENT

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MUSA IN TROPICAL AMERICA

(WITH PLATES 301 AND 302)

From the evidence accumulated by de Candolle,[1] Werth,[2] and E. Nordenskiold,[3] it seems conclusively proven that the esculent bananas have been introduced into America by the whites and heretofore no living indigenous species of the genus Musa has been known from America.

In 1895 Engelhardt[4] described certain fossil leaves from the Tertiary of the Rio Magdalena, Colombia, concerning which he says that in spite of much material for comparison he is not certain whether they should be assigned to genus Heliconia or genus Musa and places them provisionally in Goeppert's form-genus Musaphyllum.

In 1922 Professor Berry[5] in his discussion of a Pliocene Heliconia from eastern Bolivia refers to Engelhardt's species as probably another Heliconia but remarks in conclusion that "it represents a much larger and coarser species than the form under discussion."

[1] Candolle, Alph. de. Origine des plantes cultivées. Paris, 1883.

[2] Werth, E. Zur Natur- und Kulturgeschichte der Banane. Festschrift Eduard Hahn. 1917.

[3] Nordenskiold, Erland. The introduction of the banana into S. America. Deductions suggested by the geographical distribution of some post-Columbian words used by the Indians of S. America. 1922.

[4] Engelhardt, H. Ueber neue Tertiärpflanzen Süd-Amerikas. Abhandl. d. Senckenb. Naturf. Ges. **19**: 25. *pl. 4, f. 1–3; pl. 5, f. 1.* 1895.

[5] Berry, E. W. Johns Hopkins Univ. Studies in Geology No. 4. 166. *pl. 3, f. 1.* 1922.

In a paper contributed in 1922 to the Eduard Seler Festschrift, Prof. H. Harms[6] discusses the plant remains thus far discovered in Peruvian Inca graves and from the material that came to his hand he describes a peculiar blackish grey-brown fruit of slender conical form, tapering distally and with a short stout stem altogether about 7 cm. long, longitudinally striate and indistinctly five-angled, within which he found five thick greyish-black angular seeds with a subtriangular pit or cicatrice upon one of the faces, these seeds measuring 18 mm. in diameter and 12 mm. in thickness. Such seeds, he observes, are known only from wild African species of Musa, of which *M. Holstii* K. Schum may be taken as example, a seed of which as figured in Engler's "Pflanzenwelt Afrikas" II. p. 379 (1908), reminds one closely of these. In the absence, however, of any known existing indigenous seed-bearing Musa in South America, there awakened in the mind of this author the suspicion that there might have been an interchange of labels such that the material before him really originated in Africa instead of Peru and finally he decides to leave the matter open pending further evidence.

A year ago during geological exploration of the far upper edge of the Amazonian plain in eastern Peru the writer was surprised to find a seed-bearing Musa of unusual appearance growing upon the edge of an Indian plantation of *Musa Sapientum* and because of the remoteness of the locality he believed that he had perhaps come upon an indigenous American species and so confided to Professor Berry who wrote in reply: "I am immensely interested in your Musa because I have some Tertiary seeds from Colombia which as near as I have been able to make out are like those of an African species of that genus,"[7] and this again is of peculiar interest in connection with what has just been written about the seeds from the Inca grave.

The relationship of the Peruvian Musa is not, however, as we might then expect, with the African species of the genus but with the species of the subgenus Rhodochlamys, the seventeen recognized species of which are confined to south-eastern Asia and the Malay Islands.

[6] Harms, H. Uebersicht der bisher in Altperuanischen Gräbern gefundenen Pflanzenreste, 157–186. *pl. 2.* Festschrift Eduard Seler, 1922.

[7] See Berry, E. W., Proc. Nat. Acad. Sci. **11**: 298–299. 1925.

This species was first seen on Rio Pisqui, a west affluent of Rio Ucayali not far from the front range of the eastern Andes, at about Lat. 8° 00′ South, Long. 75° 25′ West, where it had been planted by Chama Indians among esculent bananas because the leaves are in greater favor for wrapping fish and other food to be boiled or roasted than are the larger leaves of the edible bananas. Later we found it upon the Ucayali and the Pachitea and finally on the Itaya near Iquitos and though it grows well and spreads rapidly, it had in each case been originally planted.

In no case did we find mature fruit, so we transplanted several suckers to Iquitos where we finally accumulated the notes upon which the following description and accompanying figures are based:

Length of trunk from ground to point of divergence of upper leaf-petioles in vigorous examples of this species is 2.30 meters (7.5 feet) while tip of the upper leaves reach a height of 3.70 meters (12 feet); diameter of trunk, 60 cm. above the ground, is 7 cm., and color is pale green sometimes tinged with pale pink. It suckers very freely. The leaves in attitude are perhaps slightly less spreading than those of the edible bananas. The shape of the smaller leaves is long-elliptical while larger ones are practically linear; their length from where petiole diverges from the trunk is 1.85 meters (6 feet) in good examples, of which the lamina measures 1.40 meters (4.5 feet). The width of largest specimens at widest part is 30–35 cm.; the apex is oblique-truncate, right side[8] rounded and entire, the left square with the margin usually somewhat frayed, the base decurrent upon the left side 2 to 4 cm. more than upon the right.[9] The glabrous lamina is dark green above and paler greyish-green beneath, where it is faintly glaucous when young. The midrib is 1 cm. wide below and is much lighter in color than the body of the lamina. Upon the under surface it is covered with a heavy bloom in the young leaf and may be tinged with flesh pink. The primary laterals usually occur at intervals of 8–10 mm. and make angles with the midrib ranging from nearly 90° at the base to

[8] The term "right" is here used with respect to leaf itself without regard to position of observer.

[9] Out of a collection of the leaves of twelve different varieties of edible bananas two were found to have laminae equally decurrent upon both sides of the petiole (one of these is *Musa Cavendishii* and the other is the red-fruited banana sold occasionally in northern markets). All the others had laminae unequally decurrent but with greater extension downward upon the right side.

60° near apex on left side, and to 40° near apex on right side. They bend forward sharply near the margin, which is black and scarious for one millimeter all around the leaf. Midway between the primary laterals occur secondary laterals somewhat less prominent and between these and the primary laterals occur tertiary laterals less prominent still and the resulting interspaces 2 mm. wide are again traversed along the center by fainter nerves between which and their stouter neighbors occur 4 nervils at intervals of .25 mm. This plan, with varying degrees of regularity, distinctness, and intervals, is common to other species of this genus and to those of the related genus Heliconia as well.

Inflorescence. Inflorescence is erect, the staminate flowers developing, unfolding, and falling without interruption to the time of maturity of the fruit.

The glabrous spathe is long-triangular-lanceolate 30 cm. (12 inches) long or less and 8 cm. wide near the base, glaucous beneath. Across the middle portion the nerves occur at an average interval of 2 mm. The color is pale purplish red toward base and greenish white toward apex with narrow green margin above. The spathe persists until the clusters of pistillate flowers have all unfolded and their bracts fallen away, when it too becomes detached and falls. The somewhat fleshy base sometimes so clasps the stem that it may persist for several days even after the staminate flower clusters begin to unfold, as happened with the inflorescence figured on PLATE II.

Pistillate flowers occur in rows of six, each row with a large ovate subtending bract. The number of such rows, as well as the number in each row is less where the plant has not been favorably situated with regard to soil or light. More than 9 rows have not been observed. In color these bracts range between tourmaline-pink and vinaceous-lilac of the Ridgeway color standards, except that the subapical region for a centimeter or less is white, while the very extremity for a millimeter or two is yellow. The lower bracts attain a length of 22 cm. and a width of 9 cm., decreasing in size upwards. Once the flowers within have been exposed, the bracts survive for a day or two only. The orange-colored perianth is truncate-ovate with the distal margin acutely denticulate. There are invariably 5 cusps, of which the outer ones are slightly the more prominent. Two ribs extend from base almost to the angle between the outer cusps and the cusps next within. When in place upon the ovary the perianth overlaps for several mm. Its length is 30 mm. and width 21 mm. The free petal is nearly linear, somewhat boat-shaped, of nearly the same length as the perianth, 26 mm. long and 12 mm. wide, apex obtuse, the subapical margin erose. The color of axial portion, distad, is very pale yellow and remainder is translucent white. There are five abortive somewhat unequal stamens about

PLATE I

BASSLER: MUSA IN TROPICAL AMERICA

half the length of the style or 10 to 15 mm., without a vestige of anthers. The pistil over all is about 70 mm. long, of which the style comprises 25. The stigma is abruptly clavate, consisting of six swollen indistinct lobes. The ovaries are 40 to 45 mm. long and 7 to 10 mm. in diameter, those at the ends of the rows somewhat triangular in section and those within, roughly trapezoidal. They are three-celled, with two rows of ovules in each cell.

The staminate flowers occur six in a row and each row subtended by a bract of the same character as that subtending the pistillate flowers, though a little smaller, 12 cm. long and 6.5 cm. wide in vigorous plants. Perianth is 40 mm. long and 10 mm. wide. The five stamens are 45 mm. long, extending several mm. beyond the perianth, of which the dark purple anthers comprise a third. The abortive pistil is 15 mm. long. Between the 6 to 9 rows of pistillate flowers and the staminate flowers above, there occur two or three rows of neutral flowers with perianth and free petal intermediate in shape between those of the pistillate and staminate flowers. The five abortive stamens are 15 mm. long and the abortive style is of equal length. The stamens are purple for distal half and have vestigial anthers and the pistil has a vestigial stigma.

The fruit is turgid, short-allantoid, slightly curved, 60–70 mm. long and 20–24 mm. in diameter with 3 or 4 rather obscure longitudinal angular ridges. The color when mature is green, usually somewhat blotched with brownish black. There is a short beak. The white pulp, which scantily invests the seeds, has a pleasant banana flavor.

The seeds are black, with a brownish tone when dry. They are thick lentiform and somewhat polyhedral, 5 to 6 mm. across and 3–4 mm. through, axially. The surface is verruculose with a little boss upon the distal surface and a very conspicuous acetabuliform hilum 1.5 mm. in diameter on the reverse side. These seeds to the number of 60 to 80 crowd the space within the peel, the white pulp filling the narrow interspaces.

Fawcett[10] in his excellent monograph on the banana gives brief description of all the described species of the genus, examination of which soon indicates that the only species that need be considered for comparison is *Musa coccinea* Andr., the entire brief description of which as given by this author I may well quote:

"Trunk 4–5 ft. long, 2–3 ins. in diameter, suckering. Leaves 2-3 ft. long. Inflorescence erect about 1 ft. long. Bracts of a brilliant scarlet tipped with yellow, 1 in. or more long. Free petal, nearly as long as perianth. Fruit oblong, three-angled, 2 in. long.

[10] Fawcett, Wm. The Banana. London, 1921 [ed. 2].

Seeds very small, rarely produced in cultivation. Southern China and Cochin China. Yields a fibre of poor quality. This species is very ornamental."

This description differs in no essential feature from that of the Peruvian plant except that the seeds of the latter are of fair size and literally fill the fruit, but since this depends upon cultivation it may be dismissed. May this not then after all be *Musa coccinea* Andr., brought to South America by some enterprising Chinaman?

HARVEY BASSLER.

DESCRIPTION OF PLATES I (301) AND II (302)

PLATE I (301). *Musa coccinea* Andr.(?). Crown of stem, showing leaves and inflorescence, much reduced.

PLATE II (302). *Musa coccinea* Andr.(?).

FIG. 1. Inflorescence (about one-fourth natural size).

FIG. 2. Staminate flower; a little more than one-half natural size. a, perianth; b, free petal; c, stamens; d, abortive pistil.

FIG. 3. Pistillate flower; reduced as in Fig. 2. a, perianth; b, free petal; c, pistil with abortive stamens; d, sections of different ovaries.

FIG. 4. Neutral flower; reduced as in Fig. 2. a, perianth; b, free petal; c, pistil with stamens both abortive.

FIG. 5. Fruit; reduced as in Fig. 2.

FIG. 6. Seed; reduced as in Fig. 2; about twice natural size.

SEEDS AS CARRIERS OF DISEASE[1]

One usually thinks of a seed as a reproductive body containing the embryonic plant, which is capable of growth, development, and reproduction under favorable conditions. We are also familiar with seeds used as food, and as such they form a most important part of the diet. They are manufactured into bread, cakes, breakfast foods, coffee, nut foods, and delicacies in various forms, and so forth.

That seeds may carry and disseminate germs causing disease in plants, thereby initiating veritable epiphytotics, as the epidemics of plant diseases are called, has been known for years to the plant

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, November 14, 1925.

PLATE II

Fig. 1

Fig. 2.

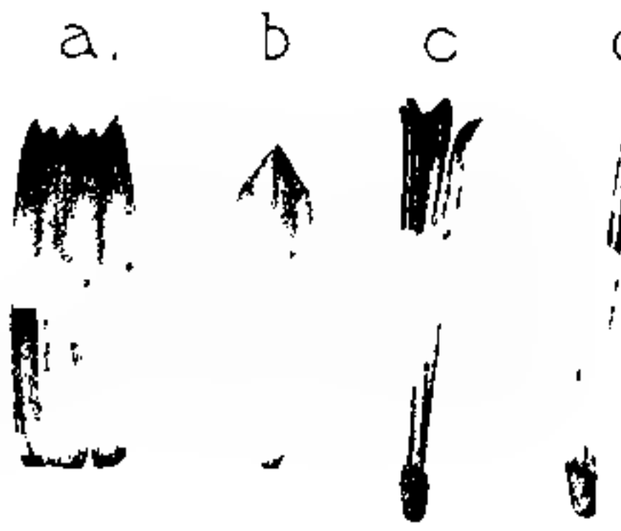
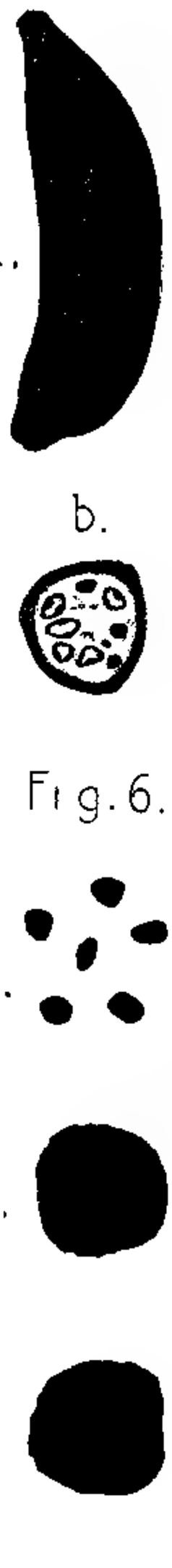


Fig. 5.



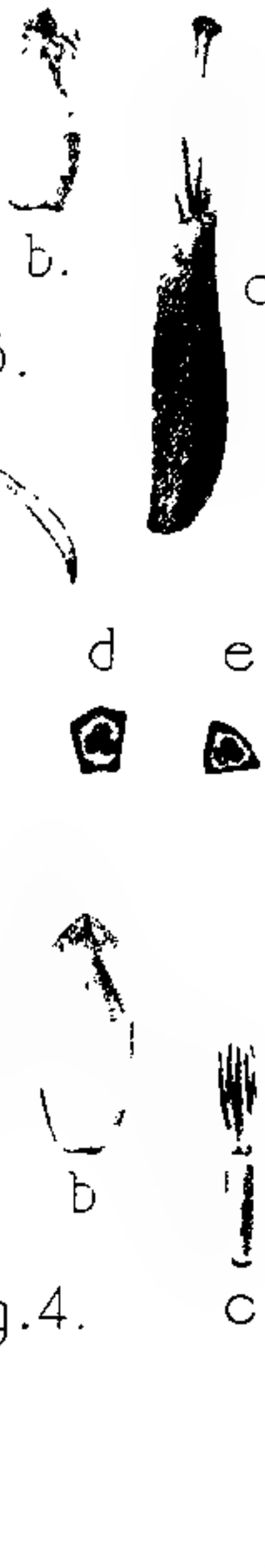


Fig. 3.

Fig. 6.

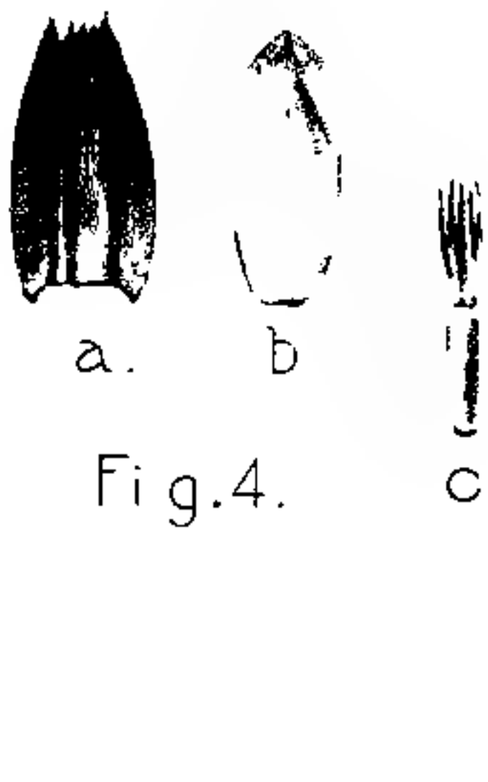


Fig. 4.

pathologist, but to most people this is a surprising fact. That the seed itself is frequently destroyed by microscopic organisms during storage and germination is also of considerable importance.

As a reproductive body, the seed has been of great interest to botanists for many generations, and its normal functions of respiration and germination have been studied rather intensively. To-day one can readily ascertain the chief features of these functions as they pertain to the periods of dormancy and germination; also the features of the development of the embryo from a single fertilized cell through its development and unfolding to form the seedling which later produces the plant.

On the other hand, should one desire to learn something of seeds as carriers of parasites producing plant disease, it is probable that such a person would find out that our cereal seeds, such as wheat and oats, are disinfected more or less regularly by farmers to prevent such diseases as bunt, or smut.

While a few facts such as these are widely known among farmers, little systematic study of the relationship of seeds to plant diseases has been undertaken. The real reason for the long delay in starting such investigations is apparently the lack of definite information regarding the importance of the seed as a carrier of disease.

Some years ago I started to collect data on this subject and to make a list of seed-borne parasites. Some of my colleagues became interested and have assisted me so that today we have a preliminary working list of 200 or more parasites which are known to be carried by seeds, but I am certain that a great many undemonstrated cases of this sort exist, and I feel sure that eventually we will know of hundreds and perhaps thousands of them.

An idea of the economic importance of seed-borne diseases in agriculture will be interesting at this point. A careful record of the losses occasioned by certain of these diseases has been kept for some years by the Plant Disease Survey of the United States Department of Agriculture in coöperation with the plant pathologists of the several states. The following data have appeared in "The Plant Disease Reporter":

ESTIMATED REDUCTION IN YIELD OF 10 LEADING CROPS CAUSED BY FUNGI, BACTERIA, ETC., 1918–24. (EXCLUSIVE OF INSECTS.)

Crop*	1918	1919	1920	1921	1922	1923	1924	7-yr. av. loss
Wheat	33,171	192,275	104,129	80,592	83,795	105,292	84,963	97,745
Barley	16,533	10,445	9,747	9,249	8,979	11,964	7,390	10,615
Oats	63,396	78,353	78,199	99,159	72,297	83,862	112,425	83,956
Corn	158,533	200,050	220,862	297,561	187,524	368,305	253,911	240,964
Potato	78,094	86,997	119,474	79,518	120,943	80,125	107,681	96,119
Sweet Potato ..	47,136	58,841	39,150	38,879	21,126	25,636	15,471	35,177
Dry Beans .	—	435	404	1,495	1,263	1,764	—	—
Cotton	2,160	1,742	2,002	1,568	417	2,439	1,905	1,748
Apple	19,273	18,920	47,474	12,380	59,120	29,917	41,239	32,618
Peach	3,664	7,026	10,505	5,918	13,068	2,923	5,370	6,925

* Losses stated in bushels, except for cotton, which is expressed in bales. 000 omitted in all cases.

The estimated percentage loss to these crops taken from "The Plant Disease Reporter" (Suppl. 43, Oct. 1, 1925) is as follows:

ESTIMATED PERCENTAGE LOSS TO TEN CROPS FROM PLANT DISEASES, 1919 to 1924

	Percent loss						
Crop	1919	1920	1921	1922	1923	1924	6-yr. av. loss
Wheat	16.96	11.70	9.2	8.9	11.82	8.87	11.24
Barley	5.90	4.60	5.7	4.6	5.68	3.78	5.05
Oats	5.90	4.80	8.6	5.6	6.06	6.79	6.29
Corn	6.41	6.39	8.8	6.0	10.70	9.43	7.96
Potato	19.50	21.70	18.6	21.1	16.20	19.15	19.28
Sweet potato .	36.23	25.8	28.3	21.49	20.9	17.72	25.07
Dry bean ...	3.70	4.3	14.1	16.1	10.0	—	25.07
Cotton	13.59	13.4	15.8	9.2	19.5	12.65	14.02
Apple	11.37	16.5	11.3	22.5	13.20	18.68	15.59
Peach	12.04	19.4	15.3	18.6	6.0	9.41	13.46

The enormous annual loss to the crops listed above will serve as an illustration of what is happening in a proportionate way to many of our cultivated crops. Such losses would be national calamities were they exceptional and occurring only at rare intervals, but because they occur yearly they have come to be taken more or less as a matter of course and little thought is given to

them. Such an attitude is regrettable, for these losses are real and could be prevented largely, at a relatively slight cost. In fact, with a number of crops the control of plant diseases offers by far the best opportunity of increasing the profits of the grower.

It should be understood that the above list of crop losses includes several diseases attacking each crop. If we were to consider only the losses from those diseases which are strictly seed-borne, we would eliminate the apple and peach crops and modify the losses to the white and sweet potato by stating that in their case the diseases are carried on seed tubers used in propagation. Such a revision would cut down somewhat the average loss for each crop but there would remain possibly 50 per cent. or thereabouts of the totals given in the table. More specifically, we may state that seed-borne parasites in the United States are responsible for losses amounting to 2.3 percent of the wheat crop, 3.1 percent of the barley crop, 3.2 percent of the oat crop, 6.1 percent of the bean crop and many other crops in proportionate amounts.

The question naturally arises as to when and how this condition started. That plant diseases are carried on the seed was suspected as far back as 1730 and proved in 1781, but it was not until the latter part of the 19th century that the significance of these facts was appreciated. During the past 25 years many cases of seed-borne parasites have been demonstrated, and along with these studies some advance has been made in the prevention of the spread of plant diseases by the use of seed disinfectants.

Unfortunately the situation was not understood until many of the most destructive of these parasites had been widely distributed throughout the world by the interchange of plant seeds and plant parts such as cuttings, bulbs, and so forth, used for reproductive purposes.

In North America, for example, we have introduced from foreign countries numerous very destructive plant diseases on the seed of crop plants. Among these are the smuts, stripe diseases, scab and ergot of wheat, oats, barley, and rye; black-leg of cabbage; most of the important potato diseases such as late-blight, leaf-roll, mosaic, wart, etc.; bean anthracnose; early and late-blights of celery; anthracnose and downy mildew of cucumber; downy mildew of onion; pea diseases, and many others. In fact, it is difficult to cite many important plant diseases in the United States which have not been brought in from foreign countries on seeds or other reproductive parts of plants.

Of course the mere introduction of these parasites is only the first step. Once introduced, however, the spread is rapid and but a few seasons elapse before they have become as widely distributed as the crops upon which they prey.

We have considered the introductory phases of the subject, including its economic importance. Let us turn now to the more technical phases of the problem.

The farmer growing wheat or oats knows that when a crop becomes smutted he must either treat the seed or must discard such a crop for seed purposes the next season. For the same reason we know that it is impossible to grow a clean, healthy crop unless clean, disease-free seed is planted. This is a prime requisite for clean crops.

The organisms which are seed-borne and which produce seedling diseases, blights, and so forth belong to four general groups, apparently. They are all microscopic germs which research students have been able to classify on morphological and physiological characters in much the same way as botanists classify higher plants. These four groups are: (1) *bacteria,* (2) *fungi,* (3) *nematodes* (eel worms), and a fourth group which includes the "mosaic-" and "yellows-"producing diseases, a few of which are seed-borne, but regarding the etiology of which we are still in doubt.

The first two groups may be carried as spores on the surface of seeds, when they are spoken of as external; or their vegetative growth (mycelium) may penetrate the seed coat or even the embryo, when they are classed as *internal.* Good examples of the externally borne type are stinking smut of wheat, covered smut of sorghum, and many others. The internally carried types are well illustrated by the loose smut of wheat, bean anthracnose and blight, fusarium and diplodia diseases of corn, and so forth. Nematodes are sometimes carried on the surface of seeds but more generally in gall tissues along with seeds. The method of transmission of the organisms causing mosaic and related diseases is unknown but by analogy we may presume they should be classed as internal.

All of these parasites are capable of remaining alive within or upon the seed for long periods; certainly overwintering and in many cases probably remaining alive as long as the seeds are viable. When such infested or infected seed is planted and ger-

minates, these accompanying parasites start growth and attack the seedling or young plant in various ways. Often such attacks result in the commonly recognized seedling blights; probably fully as often the sprout never reaches the light, being killed in the early stages, resulting in poor stands, or poor germination, as it is usually called under field conditions. Sometimes no marked effect is to be noted until the plants are nearing maturity, or when they arrive at the reproductive stage. All variations of attacks and effects occur so that the observer is frequently at a loss to explain certain symptoms.

The ideal method of disease control is through the development of resistance and immunity. Considerable advance along this line has been made already and will progress more rapidly in the future, but the process is a slow one, particularly when we find that we have to deal not only with strains of each parasite, each showing different degrees of parasitism and adaptation but also with different strains of the host, each of which reacts differently to each strain of the parasite. This so complicates the question of breeding and selection in the development of resistance to disease that it appears that many years of strict application to this problem will be required before it is satisfactorily worked out. In the meantime it would be short-sighted to neglect putting into effect the methods which we know to be effective in destroying these seed-borne parasites and thus materially reducing the great losses which result from sowing such infected seed.

Seed treatments have been in more or less successful operation for many years, but the materials utilized for this purpose have had too restricted an application for the needs of the problem. Copper sulphate was used by Tessier as far back as 1789 for bunt. Prevost used it successfully in 1807 and it was generally introduced by Kühn in 1859, but throughout its use many cases of injury to the seed have occurred. In 1902 Tubeuf introduced copper carbonate but this material did not develop to any extent until Darnell-Smith published his results in Australia in 1915. This material was taken up shortly thereafter in California by Mackie and Briggs and as a result, in a relatively short time, copper carbonate has become the chief seed disinfectant for wheat in America. However, its utility is obviously restricted to the surface-carried types such as bunt, and it cannot be generally utilized on all kinds of seed because of its toxicity.

Much the same situation exists with formaldehyde, introduced as a seed disinfectant by Arthur and Bolley, and with inorganic mercury (corrosive sublimate). Both are powerful disinfectants but their usefulness is restricted on account of their toxic action on many kinds of seeds.

By far the most effective seed disinfectants which have been tested are the organic mercury compounds first developed and introduced by Friedr. Bayer & Co. in 1912. Chlorophenol mercury was found to possess high fungicidal properties and was first found to be especially effective in the preservation of wood for mine props, railroad ties, and telegraph poles, but because of its high cost it proved impractical for such purposes. It was then tested as a seed disinfectant for rye and other cereals, where it proved to be especially effective because of its fungicidal action and low toxicity to the seed. Later the nitro-phenol mercury compounds were developed. These show even higher fungicidal properties but on the other hand appear to be more toxic to plant tissues and for this reason have a narrower margin of safety in their application. The cyan-cresol-mercuries appear to have similar properties as seed disinfectants to the nitro-phenol group. Certain of the organic mercury compounds possess the following properties which make them nearly ideal seed and plant disinfectants:

(1) They possess high bactericidal and fungicidal properties.

(2) They are only slowly toxic to plant tissues, thus eliminating very largely the injurious effects which made the older disinfectants objectionable. For this reason they can be used at varying strengths and periods of exposure without danger of serious injury. This is particularly true of the chlor-phenol groups.

(3) They do not corrode the ordinary metals, which makes them more adaptable to field operations than inorganic mercury.

(4) They possess a selective action upon the growing tissues of higher plants and the lower types of life such as bacteria and fungi. This action makes them especially valuable in the control of such plant troubles as "damping-off" and other diseases produced by soil organisms which attack plants on the roots or stems near the soil.

Thus, tender seedlings may be sprayed and the soil about them disinfected without injury to the seedlings if the work is properly done.

(5) In addition to possessing high germicidal properties, they also possess insecticidal properties. They have thus been shown to be effective in ridding the soil of maggots and similar forms which are serious root pests of plants. In this connection certain of these organic mercuries may be applied to the soil without injury to the plants *in situ*.

(6) They are available in both dust and liquid form and are thus readily adapted to various purposes.

It is thus obvious why the organic mercury compounds are superior to the old standard disinfectants. A much greater latitude of application, safety, and a greater efficiency render them especially valuable.

In order to show how these organic mercury compounds affect yields through seed treatment, a few results of experiments at the Boyce Thompson Institute may be cited. Johnson County White Dent seed corn was treated May 1, 1925, dried, and planted June 4 in the field in duplicate plots. The results were as follows:

Treatment at 22° C.	Germination percent.	Yield in bu. per A.	Bu. per A; increase (+) or decr. (−) comp. with check.
Uspulun (1–400) 1° 30′	81	109.0	+ 8.6
Water, 1° 30′	76	99.1	− 1.3
Bayer Dust, 1° 30′	84	110.7	+ 10.3
Untreated (check), 1° 30′	81	100.4	00.0

Increases of 8–10 bushels per acre are very satisfactory and indicate what has been generally obtained in extensive trials in the corn belt.

The effect of similar treatments upon sweet corn are even more significant, possibly because sweet corn quite generally carries a high percent of internal infection. Country Gentleman seed corn treated May 8, dried, and planted June 5, in the field in duplicate plots gave the following results:

Treatment at 22° C.	Germination percent.	Yield in bu. per A.	Bu. per A; increase (+) or decr. (−) comp. with check
Uspulun (1–400) 1° 30′	65	66.5	+ 10.7
Bayer Compound (1–400) 1° 30′	62	63.8	+ 8.0
Corrosive sublimate (1–2000) 1° 30′	54	36.2	− 19.6
Bayer Dust 1° 30′	70	63.8	+ 8.0
Untreated (check) 1° 30′	59	55.8	00.0

Here again significant increases in yield resulted from the use of Uspulun (chlor-phenol-mercury compound), Bayer Compound (nitro-phenol-mercury compound) and Bayer Dust (nitro-phenol-mercury dust) while corrosive sublimate, even in a very dilute solution, gave pronounced injury.

When such seed as corn is very heavily infected with fungi such as *Diplodia* a hot liquid treatment will frequently give most startling results as instanced by a lot of Stowell's Evergreen seed which was treated May 8 and planted in duplicate June 3, 1925, with the following results:

Treatment at 50° C.	Germination percent.	Yield in bu. per A.	Bu. per A. increase (+) or decr. (−) comp. with check
Uspulun (1–400), 30′	52	107.6	+ 25.0
Water, 30′	28	65.6	− 17.0
Untreated (check) 30′	43	82.6	00.0

Navy beans were treated May 11 and planted June 9 with the following results:

Treatment at 22° C.	Germi-tion.	Yield in grams shelled beans per rod row.	Grams increase (+) or decr. (−) comp. with check.
Uspulun (1–400), 1 hr.....	78	463	+ 108
Bayer Compound (1–400), 1 hr.	78	446	+ 91
Water, 1 hr.	50	97	− 258
Bayer Dust, 1 hr.	78	497	+ 142
Copper carbonate dust, 1 hr. ..	42	252	− 103
Untreated (check), 1 hr.	70	355	000

Of significance are the outstanding increases from Uspulun and Bayer Dust and the decreases caused by water and copper

carbonate treatments. Here we see that copper produces a toxic action and therefore cannot be used in this form on beans.

The results presented above are typical examples of what may be obtained with the organic mercury treatments of seeds provided the proper temperatures and exposures are used. They have also been found of great value in the preservation of seeds requiring long periods of dormancy in the soil or stratification medium prior to germination and where such seeds untreated may be nearly or entirely killed by bacterial and fungous parasites.

In conclusion it may be stated that certain of the organic mercury disinfectants present the best remedy for seed disinfection of which we are aware at the present time. Their utilization is continually extending to a wider range of purposes and it appears that in them we have a very effective weapon in combating the disastrous spread of seed-borne plant diseases, as well as in prevention of molds and bacteria which destroy seeds as such during the periods of storage and germination.

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TREES AND SHRUBS IN WINTER[1]

The study of our native and introduced trees and shrubs is far more interesting during the spring, summer, and early fall months, when nature is arrayed in all her finery of foliage and flower, than during the bleak, dreary wintry season. At this time of the year they have apparently lost all their attractiveness, except for the few fruits which persist on the branches and are eagerly sought for by our little feathered and furry folks of the hillsides, forests, and meadows.

The winter study of trees and shrubs is, however, far more entertaining than might be expected. Without flowers, and in most cases also without fruits, the two most important guides in

[1] Abstract of a lecture and demonstration given in the Central Display House of Conservatory Range No. 2, on Saturday afternoon, February 13, 1926.

the classification of plants, we are obliged to depend on the less conspicuous characters. These are found in the leaves and fruits (when present), the leaf-scars, buds, twigs, bark, and pith.

The most salient character to be found among the trees and shrubs during winter months is in the absence or presence of leaves. In many of our trees and shrubs the leaves fall off in the autumn by detachment at the base of the leaf-stalk. Such trees and shrubs are called deciduous. In others the leaves persist throughout the winter, and are referred to as evergreens. Cone-bearing trees are not always evergreen, neither are all evergreens cone-bearers. Pine, spruce, fir, and hemlock are examples of evergreen cone-bearing trees. The larch on the other hand is a deciduous cone-bearer which sheds its soft pale-green leaves rather early in the fall.

Leaves of the broad-leaved evergreens may be distinguished by the following characters: simple or compound; opposite, alternate, or whorled; petioled, or sessile.

The Heath Family is well represented among our broad-leaved evergreens which includes such familiar shrubs as Mountain Laurel, Rhododendron, etc.

The true Rhododendrons are among our most highly ornamental woody plants, and are grown chiefly for their beautiful flowers which appear during the latter part of June and in July. Their large leathery evergreen leaves make them attractive throughout the year. Many species and varieties are under cultivation. The Rose Bay or Great Laurel is the only Rhododendron native in the region within one hundred miles of New York City. It grows mostly in the mountains and in localities more or less elevated, and also occurs locally near the coast. It is very abundant along the banks of running streams, and on the shores of lakes, sometimes growing in such profusion as to form an almost impenetrable thicket.

Next to the Rhododendrons, the Mountain Laurel is our most beautiful flowering shrub. On account of its unusual beauty, the flower of the Mountain Laurel has been suggested as our national floral emblem, but unfortunately it is popularly known only in the eastern states. The leaves and twigs of the Kalmias, particularly those of the Sheep Laurel or Lambkill, are among our most dangerous poisons to live-stock. During the winter

months, the evergreen leaves and twigs are often consumed by grazing cattle, especially sheep, sometimes causing considerable loss among a herd.

In some of our leading horticultural works and text-books, the Azaleas are grouped with the Rhododendrons, but all of our eastern species, which lose their leaves at the approach of winter, appear quite distinct. The Japanese Azalea, because of its brilliant flowers, evergreen leaves, and low compact habit, lends itself especially to border decoration. The Chinese Azalea, also an evergreen shrub, is under cultivation in several forms.

The Mountain Fetter-bush, better known in trade catalogues as *Pieris floribunda,* is native of the dry mountain slopes from Virginia to Georgia. It is one of the most desirable evergreens on account of the earliness of its flowers, which are borne in dense upright clusters. The Japanese Pieris also flowers early in the spring. It may readily be distinguished from the American plant by its drooping flower clusters.

Of the hollies, there are only two native evergreens in our immediate vicinity. The Inkberry or Evergreen Winterberry, as it is sometimes called, is a shrub 2–6 feet in height, and found in sandy soil from Long Island and New Jersey southward. Unlike the common holly, so extensively used for decorative purposes during the Christmas holidays, the leaves of the Inkberry are without prickly margins, while the berries are black instead of red. The Japanese Holly is one of the most attractive of our small-leaved evergreens, but, unfortunately, when the mercury drops to below the zero mark, they sometimes perish.

The Box, perhaps better known to many as Boxwood, is a familiar object about the country farm house and old cemeteries. It is also planted in parks and on private estates, and in the old floral gardens of Europe was formerly much used for hedges. The Boxwoods are among our most hardy evergreens and were introduced from Europe many years ago.

Fruits of trees and shrubs are sometimes persistent on the branches during the winter and usually form a good means of identification. These may be separated into two groups: fleshy and dry.

Leaf-scars are scars on twigs or branches, marking the places from which leaves have fallen. They vary greatly in size and

shape, and are sometimes crescent-shaped, horseshoe-shaped, shield-shaped, U-shaped, C-shaped, triangular, ellipsoid or half-rounded, and are either notched or straight at the top. They are alternate (when solitary), opposite (when paired), or whorled (when more than two at each node). The bundle-traces, which are conspicuous in some leaf scars, mark the places from which the woody strands have passed up into the leaf. Both leaf-scars and bundle-traces offer some of the best characters for the classification of trees and shrubs during the winter.

Some buds contain flowers, others leaves, while others contain both. The flower buds are generally larger than the leaf-buds. Accessory buds are those produced at or near the nodes (joints), but not in the axil of a leaf-scar. Of these there are two kinds: superposed—those that are located above the axillary buds—and collateral—those at either side of the axillary buds.

Pith, when present, is the usually soft central part of a stem surrounded by the wood. It may be defined as follows: abundant, scant, or wanting; continuous or interrupted; central or to one side; excavated or chambered; rounded, angled, or flat; white, greenish, salmon-colored, or dark brown; spongy or gritty.

Bark is the exterior layer or rind of woody stems or trunks. It is protective and serves to keep out injurious fungi, and to prevent excessive loss of heat and moisture.

In some shrubs and trees the bark is thin, smooth, and flexible, in others thick, rough, or deeply furrowed and brittle, while in others it is sometimes flaky or shreddy.

No one character can be depended upon to separate the plants of any one family. An illustration of this is found in the Olive Family, of which the common lilac, privet, and Golden Bell are familiar examples. In the lilac and privet we have a scant continuous pith, while in the Golden Bell the pith is either chambered or excavated. The lilac and Golden Bell have capsular fruits, the privet a black or bluish-black berry.

The sumacs and their close relatives, the Poison Sumac and Poison Ivy, are frequently met with on dry rocky hillsides, in open fields, or in sandy soil in our immediate vicinity. The former are easily distinguished from the Poison Sumac and Poison Ivy by their large, dense, erect, pyramidal fruit-clusters, which are of a reddish-brown color, and are non-poisonous.

Birds occasionally feed on these fruits when there is little else to eat.

In the autumn one is often attracted by the brilliant red foliage and pendulous grayish fruits of the Poison Sumac, which is all too abundant in some of our swamps or marshes. In one instance that I recall, three small boys gathered armfuls of Poison Sumac for church decoration, and all who came in contact with it were badly poisoned. Even smoke from fires in which dried twigs and leaves of Poison Sumac were burning has caused serious illness. The Poison Ivy is undoubtedly known to all, if not to the eye, at least by its poisonous effects. Some people are fortunate enough to be immune from the poison of both the Poison Ivy and Poison Sumac.

Although a native of China, the Ailanthus has established itself to such an extent among the trees of our woodlands as to appear to be indigenous. In fact not only will the Tree of Heaven or "Stink Tree," as it is commonly called, thrive in the fertile soil of our forests, but appears perfectly at home in the ash heaps, dumps, and back yards of our crowded city.

Cleverness is often very noticeable among some of our animals, even the insects, and one may watch with interest the caterpillar as he prepares to spin his cocoon. The large, ugly-looking creature that feeds upon the compound leaves of the Ailanthus seems to be very much awake to the fact that he is here laboring under quite different conditions from his neighbor across the way that chose the simple tulip or wild-cherry leaf. Not being thoroughly satisfied, after firmly fastening the leaflet in which he will eventually spin his cocoon, he travels back and forth, sometimes over a distance of eighteen inches, and secures the main leaf-stalk to the branch so that his winter home will not drop off like the other leaf-stalks of the tree.

The talk was illustrated by numerous specimens and preparations.

PERCY WILSON.

HISTORIC GARDENS OF NEW YORK STATE[1]

Long Island has been called " the garden spot of America." It is rich in tradition and garden interest, with its many rare trees and beautiful shrubs brought in by the Prince and Parsons nurseries for propagation purposes. Long Island has also been called " the Garden at the foot of the Statue of Liberty," but it was a garden spot some two centuries before the Statue of Liberty was dreamed of. As early as 1730 a community of French Huguenots settled on the north shore of Long Island and brought with them many cuttings and seeds of fruit trees, together with the love of horticulture that brought them success in the New World.

Robert Prince was one of these early settlers, and in 1737 founded the first commercial nursery in the New World at Flushing. The Prince nursery continued through five generations and was 130 years in the Prince family. Some thirty years later the nursery was enlarged from the original eight acres to eighty acres, and was called the Linnaean Botanic Garden, after Linnaeus, the Swedish botanist. The eighty acres of botanic gardens were the center of interest for the entire country. Every tree, shrub, vine, and ornamental plant known to America and England was eagerly sought for.

The Lombardy Poplar, introduced by the Prince nurseries, became the most popular tree in America and was considered the emblem of democracy.

The Princes were also devoted promoters of the native silk industries, having large plantations in a number of southern cities. In the year 1830, cuttings of the Chinese Mulberry were used as currency in the stores of Flushing at the rate of 12½ cents each. The Princes were also pioneers in the propagation of the grape, and many of the garden varieties of fruits. The fame of the Botanical Garden was so great that when the British troops entered Flushing, General Howe placed a guard at both gates of the garden to protect the nurseries. At the time of the revolution the Prince business was so extensive that 3,000 cherry trees, for which there was no sale, were cut down and made into hoop poles.

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, November 7, 1925.

In October, 1789, the year of his inauguration, the first President of the United States, Washington, visited Flushing to inspect the Linnaean Garden of William Prince. He remarks in his diary that the inhabitants of the place "showed us what respect they could by making the best use of one cannon to salute."

During the war, business waned, but an excellent business sprung up with the officers of the British Army who sent back material to gardens in England and Germany. Many an English garden still has ancient plants and trees from the Prince nurseries.

In comparison with America, Great Britain and continental Europe were poor in native species of trees. In all of Europe there are only about 85 species. Great Britain has less than a dozen native species, while North America has more than 400 species of trees.

Here in the Linnaean Botanic Gardens were planted the first tulips brought into the country. They created a great furor and were the Mecca for people from far and near.

William Robert Prince, who died in 1869, was the last to keep up the nurseries, which he did as a scientific rather than a commercial establishment. He botanized the entire length of the Atlantic States with Dr. Torrey, and sought for collections of trees and wild flowers in California with the same eagerness that others there sought for gold.

In time other nurseries came, and in 1838 a commercial garden and nursery was started by Samuel Parsons and his brother Robert. The Parsons Brothers were distributors of unusual plants, and were the first to bring in Japanese trees and shrubs for propagation purposes. Rare specimens of these are found in the fields and gardens for many miles in and around Flushing. The old nursery, part of which is now Kissena Park, still contains many of the rare, beautiful, and interesting plants gathered from the four corners of the earth by Flushing's far-famed nurserymen. Just recently the City has purchased the ground on which stand the Weeping Beech and the Japanese Larch, of which Professor Sargent says that they are the two most famous trees in this country. The garden clubs of Long Island are now asking the City to call the ground on which the trees stand, the "Parsons' Arboretum" as a memorial to the two Parsons brothers.

There are many rare varieties of trees in Flushing and vicinity. Robert Parsons, the veteran nurseryman, once said that the man-

ner in which Flushingites worshipped trees amounted practically to idolatry.

Just before her death, Mrs. Frances Hodgson Burnett, while sitting beneath her favorite tree in her garden, wrote " As long as one has a garden, one has a future, and as long as one has a future, one is alive."

Besides beautifully colored lantern-slides showing homes and gardens of historic interest, the speaker showed many others illustrating artistic and elaborate gardens in various parts of the state, especially on Long Island.

Last, but not least, the Federated Garden Clubs of New York State ask you to help make and keep New York the " State Beautiful."

Do your part in the work toward the

Restriction of Bill-boards.
Preservation of Scenic and Historic Places.
Encouragement of Small Gardens.
Planting and Care of Trees.
Keeping Roadsides Clean.

FRANCES JOHNSTONE PARIS,
President of The Federated Garden Clubs of New York State.

PUBLIC LECTURES DURING FEBRUARY, MARCH, AND APRIL

During February, lectures and demonstrations were given in the Central Display House of Conservatory Range No. 2 on Saturday afternoons as follows:

February 6. " Notes on the Birds in the Botanical Garden," Mr. R. S. Williams.
February 13. " Trees and Shrubs in Winter," Mr. Percy Wilson.
February 20. " Methods of Breeding Plants," Dr. A. B. Stout.
February 27. " The Planting of Flower Seeds," Mr. George Friedhof.

Following is the program of the illustrated lectures for March and April. These are given in the Museum Building of The New

York Botanical Garden on Saturday afternoons, beginning at 3:30. Doors are opened at 3:45 to admit late-comers.

March 6. "Poetry in the Names of Flowers,"
Miss Laura Lee Rogers.

March 13. "Plant Arrow-Poisons: Their Sources, Preparation, and Effects," Dr. Ralph H. Cheney.

March 20. "Wild Flowers and their Insect Visitors,"
Prof. Oliver P. Medsger.

March 27. "Botanical Travel in Peru and Chile,"
Dr. Francis W. Pennell.

April 3. "The Flowers of the Prize Garden,"
Mr. Kenneth R. Boynton.

April 10. "A Historical Review of the Study of Fossil Plants," Dr. Arthur Hollick.

April 17. "The Desert Vegetation of the Southwest,"
Prof. John W. Harshberger.

April 24. "Narcissi, or Daffodils,"
Mrs. Wheeler H. Peckham.

NOTES, NEWS, AND COMMENT

Investigators and teachers in the plant sciences, representing all aspects of botany, plant chemistry, plant pathology, bacteriology, agronomy, and forestry, are invited to attend the International Congress of Plant Sciences to be held at Ithaca, New York, August 16–23, 1926. This invitation is extended to all countries of the world. The Congress will be divided into about one dozen sections, each section with an invitation program occupying about four morning sessions. Although the Congress is not to provide an occasion for legislation on regulatory matters of international significance (such as rules of nomenclature), the organizing committee has expressly provided that "adequate opportunity shall be accorded all sections for *discussion* of regulatory recommendations of international significance," in order that a better understanding may be reached for definite action at a subsequent international congress.

Doctor Fred J. Seaver, mycologist for the Garden, recently returned from a five-weeks mycological expedition in the Bermuda Islands, in company with Professor H. H. Whetzel, of the Department of Plant Pathology, of Cornell University, and Mr. Lewcock, a student from Australia. A large collection of fungi was brought back for study. Mr. Lewcock has been spending a year in the University of Wisconsin investigating the diseases of the prickly pear cactus, hoping to discover some natural enemy which may be used in combating the cactus pest in Australia, where this plant, introduced from America, has overrun more than sixty million acres of ground and made it worthless for agriculture. The fungus described by Doctor Seaver in North American Flora was observed by Professor Whetzel to be very destructive to the prickly pear in the Bermuda Islands and at his suggestion Mr. Lewcock undertook this trip in order to study the effects of this disease in those islands, looking toward the possibility of using this parasite for the purpose indicated above.

Meteorology for January. The total precipitation for the month was 3.28 inches, of which 0.40 inch (4 inches by snow measurement) fell as snow. The maximum temperatures recorded for each week were 51° on the 6th, 45° on the 15th, *54° on the 18th,* and 41° on the 31st. The minimum temperatures were 19° on the 8th, 13° on the 13th, 14° on the 23rd, and *5° on the 29th.*

Meteorology for February. The total precipitation for the month was 4.72 inches, of which 2.45 inches (24.5 inches by snow measurement) fell as snow. The maximum temperatures recorded for each week were 43° on the 7th, 43° on the 14th, *49° on the 15th,* and 48° on the 25th. The minimum temperatures were 12° on the 6th, *8° on the 11th,* 16.5° on the 20th, and 15° on the 28th.

PUBLICATIONS OF
THE NEW YORK BOTANICAL GARDEN

Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its twenty-seventh volume.

Mycologia, bimonthly, devoted to fungi, including lichens; $4.00 a year; single copies not for sale. [Not offered in exchange.] Now in its eighteenth volume.

Addisonia, quarterly, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Subscription price, $10.00 a year. [Not offered in exchange.] Now in its eleventh volume.

Bulletin of The New York Botanical Garden, containing reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations. Free to all members of the Garden; to others, $3.00 per volume. Now in its thirteenth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. Planned to be completed in 34 volumes. Roy. 8vo. Each volume to consist of four or more parts. 55 parts now issued. Subscription price, $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Memoirs of The New York Botanical Garden. Price to members of the Garden, $1.50 per volume. To others, $3.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the twelfth volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

VOL. XXVII APRIL, 1926 No. 316

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

THE AWARDS AND PRIZE-WINNING PLANS IN THE SMALL GARDEN COMPETITION

MARION L. PETERS, CHARLOTTE COWDREY BROWN, AND KENNETH R. BOYNTON

BOTANIZING IN THE HIGHER ALLEGHANY MOUNTAINS.—III. NORTH CAROLINA

P. A. RYDBERG

TREE-FERNS IN PORTO RICO

N. L. BRITTON

MYCOLOGICAL WORK IN BERMUDA

FRED J. SEAVER

LILIES AT THE INTERNATIONAL FLOWER SHOW

A. B. STOUT

CONFERENCE NOTES

NOTES, NEWS, AND COMMENT

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JOURNAL
OF
The New York Botanical Garden

VOL. XXVII APRIL, 1926 No. 316

THE AWARDS AND THE PRIZE-WINNING PLANS IN THE SMALL GARDEN COMPETITION

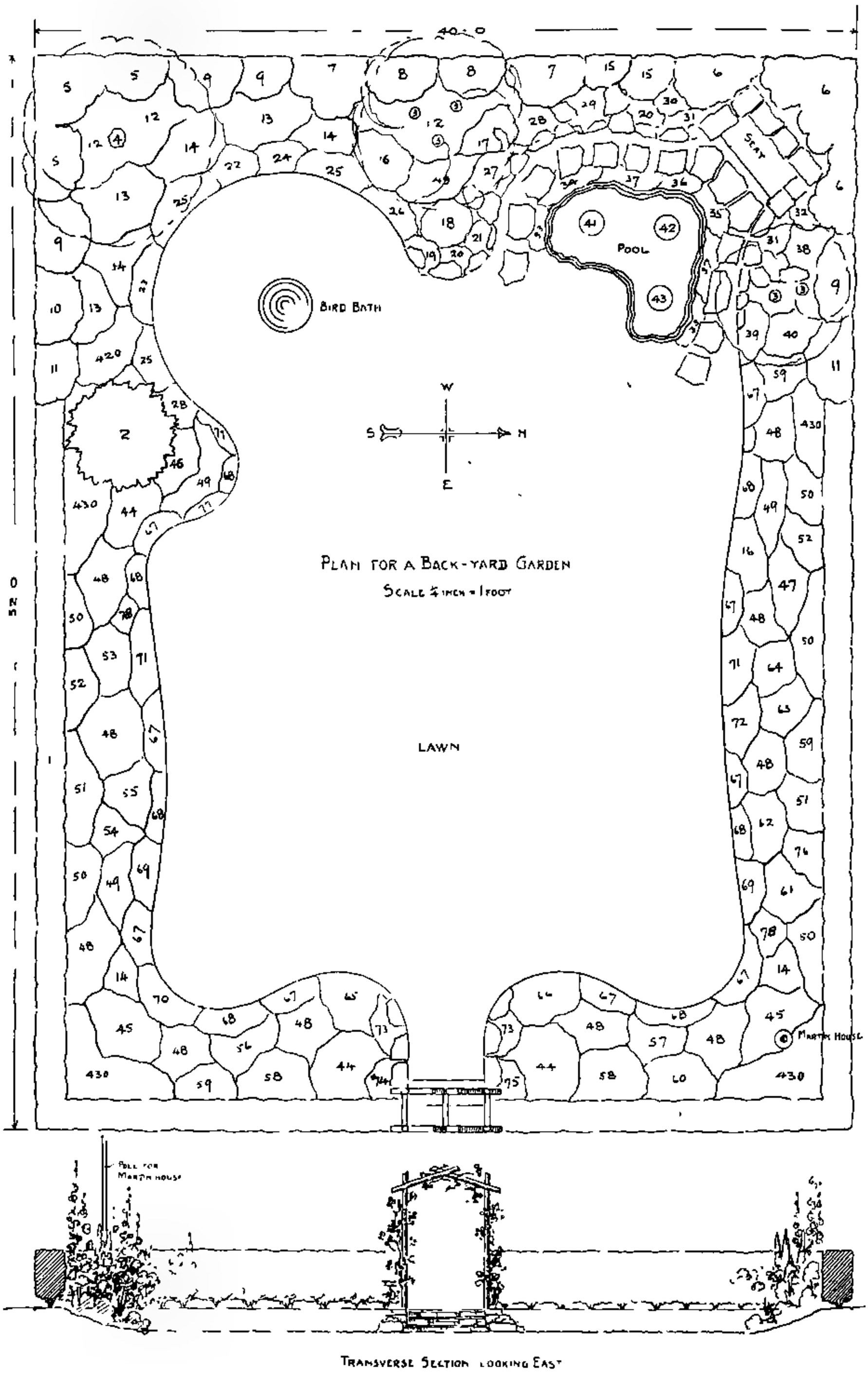
The undersigned, the jury appointed to consider the plans submitted in the "Small Garden Competition under Auspices of The New York Botanical Garden, 1926," and to award the prizes, report that 160 plans were submitted, of which 91 conformed to the conditions as published in the *Journal of The New York Botanical Garden* for December, 1925. The jury has been impressed by the high quality of most of the plans submitted and believes that the contest has done much to stimulate interest in small gardens. After careful examination, the jury awards the prizes as follows:

1. The first prize of One Hundred Dollars to
   (No. 25) ARCHIE S. HILL, 117 Greenfield Place, Wauwatosa, Wisconsin.
2. The second prize of Seventy Five Dollars to
   (No. 82) MRS. WILLIAM HARRIS CARY, 1 Pierrepont Street, Brooklyn, N. Y.
3. The third prize of Twenty Five Dollars to
   (No. 59) L. L. BLUNDELL, 61 Park Street, Brookline, Massachusetts.

(Signed) MARION L. PETERS,
Nominated by The Garden Club of America.

(Signed) CHARLOTTE COWDREY BROWN,
Nominated by The Federated Garden Clubs of New York State.

(Signed) KENNETH R. BOYNTON,
Nominated by The New York Botanical Garden.



PLAN FOR A BACK-YARD GARDEN

SCALE ¼ INCH = 1 FOOT

TRANSVERSE SECTION LOOKING EAST

FIGURE I. The first-prize plan, submitted by Archie S. Hill, Wauwatosa, Wisconsin.

THE FIRST-PRIZE PLAN

Submitted by Mr. Archie S. Hill, Wauwatosa, Wisconsin.

Key No.	Name
1.	Hedge, Privet or Japanese Barberry
2.	Arbor Vitae or Red Cedar
3.	Silver Birch
4.	Mountain Ash
5.	*Lonicera tartarica*
6.	Lilac
7.	*Hydrangea arborescens*
8.	*Hydrangea paniculata*
9.	*Viburnum Opulus*
10.	Elder
11.	Spiraea "Van Houttei"
12.	Ferns and *Narcissus poeticus*
13.	Foxgloves
14.	Aquilegia, long-spurred
15.	Snowberry
16.	Funkia
17.	*Dicentra eximia*
18.	*Yucca filamentosa*
19.	*Iberis sempervirens*
20.	*Aubrietia deltoidea*
21.	*Arabis alpina*
22.	Grape Hyacinth
23.	*Viola odorata*
24.	*Viola pedata*
25.	*Primula polyantha*
26.	*Iris pumila*
27.	*Cerastium tomentosum*
28.	*Campanula carpatica*
29.	*Alyssum saxatile citrinum*
30.	*Sedum spectabile*
31.	*Phlox subulata*
32.	*Dicentra cucullaria*
33.	Forget-me-not
34.	*Sedum album*
35.	*Sedum acre*
36.	*Dianthus deltoides*
37.	*Lysimachia nummularia*
38.	*Opuntia Rafinesquii*
39.	*Scilla sibirica*
40.	Crocus, yellow
41.	*Nymphaea Marliacea alba*
42.	*Nymphaea Marliacea chromatella*
43.	*Nymphaea Marliacea rubra*
44.	Delphinium, dark blue
45.	Delphinium, light blue
46.	*Lilium candidum*
47.	*Lilium tigrinum*
48.	Hybrid Phlox, various
49.	*Iris germanica*, various
50.	*Aster Novae-Angliae*, hybrids
51.	*Pyrethrum uliginosum*
52.	Rudbeckia, "Golden Glow"
53.	Bleeding Heart, *Dicentra spectabilis*
54.	*Liatris pycnostachya*
55.	Oriental Poppy
56.	*Lupinus polyphyllus*
57.	*Lupinus polyphyllus roseus*
58.	*Helianthus rigidus*
59.	*Boltonia asteroides*
60.	*Bocconia cordata*
61.	*Physostegia virginica*
62.	*Monarda didyma*
63.	*Aconitum Napellus*
64.	*Veronica subsessilis*
65.	Peony, "Festiva maxima"
66.	Paeony, "Jules Elie"
67.	Tulips (annuals later)
68.	Pansies (various)
69.	*Phlox divaricata*
70.	*Oenothera Youngii*
71.	*Dianthus plumarius*
72.	*Papaver nudicaule*
73.	*Alyssum saxatile*
74.	Rose, "Dr. W. Van Fleet"
75.	Rose, "American Pillar"
76.	*Hemerocallis fulva*
77.	*Bellis perennis*
78.	Platycodon "Chinese Bell Flower"
420.	*Baptisia australis*
430.	*Althaea rosea*

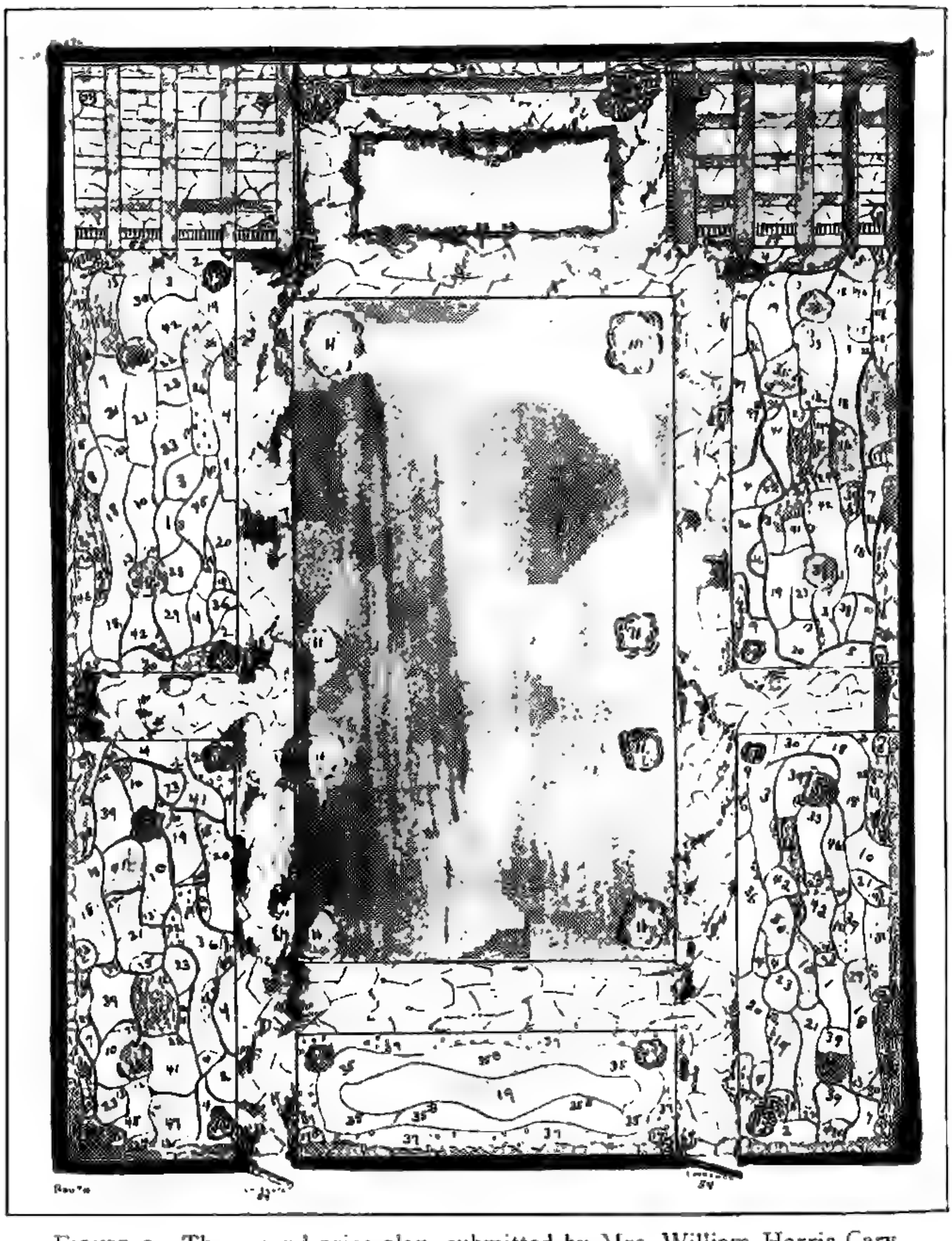
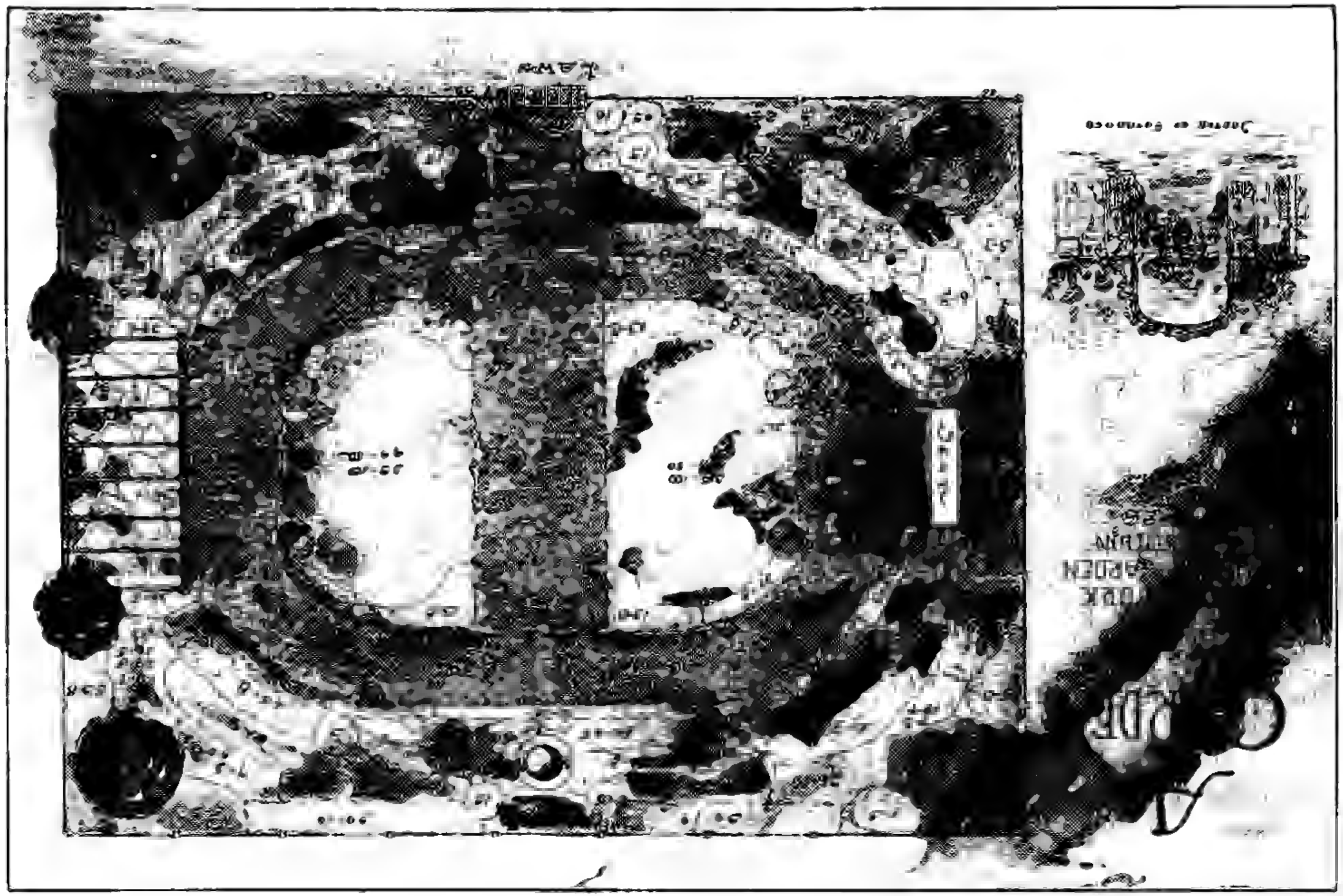


FIGURE 2. The second-prize plan, submitted by Mrs. William Harris Cary, Brooklyn, New York.

THE SECOND-PRIZE PLAN

Submitted by Mrs. William Harris Cary, 1 Pierrepont Street, Brooklyn, New York.

Plan Key	No. of Plants Used
1. Anchusa "Dropmore"	2
2. *Anchusa italica*	8
3. Aquilegia	15
4. Ageratum	24
5. Perennial Aster	4
6. (Bulbs) 6A. Narcissi, White	500
6B. Narcissi, Yellow	—
7. *Bocconia cordata*	2
8. *Boltonia latisquama*	2
9. *Campanula carpatica*	12
10. *Campanula calycanthema* (pink)	8
11. Flowering Crabs (Bechtel's)	8
11B. *Magnolia stellata*	2
12. Cottage Tulips	200
13. Darwin Tulips	250
14. Yew, pyramidal	10
15. Monarda, pink, not red	4
16. Chrysanthemums, hardy	60
17. *Clematis paniculata*	3
17B. *Clematis Jackmani*	3
18. Delphinium (Hybrids)	60
19. Delphinium chinense (blue)	84
20. *Dianthus Alwoodii*	72
21. *Digitalis grandiflora, pink*	24
22. Gladioli	200
23. Gypsophila	8
24. Helenium "Riverton Gem"	4
25. *Hemerocallis flava*	3
26. Heuchera	12
27. Hollyhocks "Newport Pink"	40
28. Hollyhocks, yellow, pink, single, double	9
29. Iris, Japanese	24
30. Iris, Germanica	48
31. Linum	6
32. Wisteria, blue	4
33. *Lupinus polyphyllus*	18
34. *Myosotis palustris*	36
35. Petunia, "Balcony Blue"	72
35B. Petunia, White	48
36. *Nepeta micranthes*	36
37. Petunia, "Rosy Morn"	72
38. Peony, pink or red	8
39. Phlox, perennial, pink	24
40. Phlox, white	12
41. Polemonium	8
42. Oriental Poppy "Princess Victoria"	10
43. Roses, A. "Gardenia"	2
43. Roses, B. "Van Fleet"	2
43. Roses, C. "Tausendschön"	1
43. Roses, D. "American Pillar"	2
44. *Salvia farinacea*	12
45. *Aconitum chinense*	8
46. *Veronica spicata*	72
47. Violas	120
48.–50. Pergola	—
51. Pool	—
52. Birds' Bath	—
53. Seats	—
54. Gate	—
55. Step into Pergola	—
56. Stone wall	—



THE THIRD-PRIZE PLAN

Submitted by Mr. L. L. Blundell, 61 Park Street, Brookline, Massachusetts.

Key No.	Name	No. of Plants Used
1.	*Laburnum vulgare* Goldenchain. Size 8′–10′	2
2.	*Syringa vulgaris* Common Lilac. Size 6′–8′	4
3.	*Buxus sempervirens* Box. 2′ high; 2′ spread.	4
4.	*Ligustrum Regelianum* Regel's Privet. Size 4′–5′	4
5.	*Althaea rosea* Single Hollyhocks, Red, Pink and White	35
6.	Delphinium "Belladonna" Larkspur	16
7.	*Digitalis gloxinaeflora* Gloxinia Foxglove	22
8.	Peony "Festiva Maxima" White Paeony	4
9.	Peony "Felix Crousse" Pink Paeony	4
10.	Paeony "Reine Hortense" Red Paeony	4
11.	*Iris pallida dalmatica* Lavender Hybrid German Iris	15
12.	*Iris alpinus* "Blue King" Blue Dwarf Iris	18
13.	*Iris sibirica* Siberian Iris	32
14.	*Aster Novae-Angliae* New England Aster	10
15.	*Echinops Ritro* Steel Globe-thistle	4
16.	*Thalictrum minus adiantifolium* Maidenhair Meadow-rue	11
17.	*Astilbe japonica* Japanese Astilbe	11
18.	*Coreopsis lanceolata* Lance Coreopsis	12
19.	*Lilium auratum* Gold-banded Lily	10
20.	*Lilium regale* Royal Lily	15
21.	Phlox "Miss Linguard" White Phlox	18
22.	Phlox "Rynstrom" Crimson Phlox	5
23.	Phlox "Michael Buchner" Purple Phlox	8
24.	Aster "Climax" Lavender Hardy Aster	24
25.	Aster "St. Egwyn" Pink Hardy Aster	18
26.	*Anemone japonica* Single White Japanese Anemone	15
27.	*Anemone japonica rosea superba* Single Red Japanese A.	10
28.	*Aconitum autumnale* Autumn Monkshood	9
29.	*Cimicifuga foetida simplex* Kamchatka Bugbane	10
30.	*Cimicifuga racemosa* Black Cohosh	4
31.	*Linum perenne* Perennial Flax	43
32.	Gladiolus in variety Marshal Foch (orchid).	15
	Peace (white)	10
33.	*Veronica longifolia subsessilis* Clump Speedwell	16
34.	*Veronica virginica* Common Speedwell	35
35.	*Viola cornuta* Tufted Pansy	200
36.	*Liatris pycnostachya* Cattail Gayfeather	20

Key No.	Name	No. of Plants Used
37.	*Boltonia asteroides* White Boltonia	19
38.	*Dianthus plumarius* Moss Pink	48
39.	*Hosta Sieboldiana* Cushion Plaintainlily	12
40.	*Helianthus mollis* Ashy Sunflower	10
41.	*Aquilegia chrysantha* Golden Columbine	15
42.	*Geum ×ens* "Mrs. Bradshaw" Scarlet Geum	4
43.	*Iris striata* Yellow German Iris	16
44.	*Campanula carpatica* Carpathian Harebell	100
45.	*Baptisia australis* Blue Wild Indigo	2
46.	*Aconitum Napellus* Aconite	10
47.	*Campanula persicaefolia* Peachleaf Bellflower	5
48.	*Campanula persicaefolia alba* White Peachleaf Bellflower	6
49.	*Aquilegia canadensis* American Columbine	6
50.	*Gypsophila paniculata* Baby's Breath	6
51.	*Gaillardia grandiflora* Blanket Flower	10
52.	Chrysanthemum "Brutus" Old Gold Hardy Mum	16
53.	*Delphinium formosum* Hardy Larkspur	15
54.	*Solidago rigida* Stiff Goldenrod	16
55.	*Wisteria sinensis* Chinese Wisteria	1
56.	*Clematis paniculata* Sweet Autumn Clematis	2
57.	*Cobaea scandens* Cup and Saucer Vine (to be used the first two years only)	8
58.	*Clematis virginiana* Virgin's Bower	1
59.	Rose "Dr. Van Fleet" Pink Hybrid Wichuriana Rose	1

The New York Botanical Garden "undertakes, during the spring or early summer of 1926, to lay out and plant, in a prominent location on its grounds, a garden on the lines of the winning design, and maintain the same as a public exhibition prize garden for at least one year." Such a garden, on the lines of the first-prize plan, will be planted in connection with the flower gardens, a little to the northeast of Conservatory Range No. 1.—MARION L. PETERS, CHARLOTTE COWDREY BROWN, AND KENNETH R. BOYNTON.

BOTANIZING IN THE HIGHER ALLEGHANY MOUNTAINS.—III. NORTH CAROLINA.

On July 9, Mr. Perry and myself left Roan Mountain station, retracing our journey as far east as Elk Park, then, branching off southeast, passed through Linville, N. C., and reached the

southern end of Grandfather Mountain, at McGrey's farm, where the owner had set aside a camping ground among ancient oaks and chestnuts. The following day we climbed the mountain. There is a woodroad zigzagging up through dense hardwood forest, until it stops near the third spring. The undergrowth of the Alleghanian forest was here more varied than we had seen before. The white rhododendron (*R. maximum,* here often with pink flowers) and mountain laurel (*Kalmia latifolia*) were very common. Other shrubs collected were *Vaccinum pallidum, Hugera erythrocarpa, Gaylussacia baccata, Arsenococcus ligustrinus, Clethra acuminata, Viburnum cassinoides,* etc. Among herbaceous plants may be mentioned *Galax aphylla* (very plentiful), *Chrosperma muscaetoxicum, Thalictrum clavatum, Clintonia borealis, Trillium undulatum, Cicuta Curtissii* and *Monarda clinopodia.* Just above the end of the road are some exposed rocks, from which there is a fine view over the valley; here we met again the pretty little rock-plant, *Paronychia argyrocoma,* already collected in West Virginia. At this point began the real hard climbing. The trail turned north, circling around the steep cliffs of the first peak, mostly over rock-slabs and boulders, through crevices, up almost perpendicular walls until we reached the rim, a little nearly flat plateau, between 200–300 feet long and perhaps 25 feet wide. We rested here for a while and looked at the fine view over mountains and valleys. We could see Linville and Boone, Grandmother Mountain to the south, Mt. Mitchell and other mountains of the Black Range to the southwest, Roan Mountain to the west, and Beach Mountain to the northwest, all 6,000 feet or more high. Then we descended to the big shelf below, crossed over a small valley to the next knoll northeast. In the depression grew many blueberries. In an open place we found *Oceanorus leianthemoides,* an interesting plant of the bunch-berry family. In the crevices of a steep cliff we found a little fern, *Asplenium montanum,* and at the foot two lycopods and sphagnum. Reaching the next terrace we found it flat on top, covered by *Rhododendron catawbiense, Dendrium Lyoni, Gaylussacia baccata,* and blueberries. We followed a trail which ran along the northwest side of the ridge, then on top of it, down into a depression, then up for a distance towards the top of the highest knoll of Grandfather (his "nose"), which is covered with thick woods of spruce and balsam. The trail

branched. I followed the southern branch and found that it descended the mountain. We took the western branch which ran for a mile or so nearly horizontal until it came right opposite the highest point. The hardwoods here were more of a northern type, consisting mostly of birch and maple, here and there mixed with spruce and the mountain ash, (*Sorbus americana*). The undergrowth contained also northern species, as *Clintonia borealis, Streptopus roseus, Viburnum alnifolium, Kalmia latifolia, Rubus canadensis,* etc. As we did not find any trail leading upwards, and as it was time for us to return if we wished to arrive at the camp before dark, we gave up trying to reach the spruce- and balsam-covered summit. We returned the same way we came. When passing around the steep southern cliff mentioned above, we saw in a crevice about 20 feet above our heads a stonecrop with white flowers. It was impossible to reach it. Mr. Perry took out his pistol intending to shoot it down, but refrained from firing, as we heard voices from the trail below. Instead he began to throw rocks and succeeded in knocking down half a dozen branches. It has turned out to be a new species of *Rhodiola.* Another indigenous and local species of the same genus, *R. roanensis,* with purple flowers, grows on Roan Mountain, where it has been collected by Small, Heller, Canby, Patten, Cannon, and Weatherby. We did not succeed in finding it.

The 13th of July was windy and it rained in small showers. We collected for a while between our camp and the first spring on the mountain side. On the following day we resumed our travel through Linville, Pinola, with its rhododendron nurseries, Marion, N. C., and Old Fort to near Black Mountain, where the mountain road to Mt. Mitchell branched off. Here we camped. The scenery between Old Fort and this place was magnificent; the road ran high up on the mountainside overlooking the river. The road up to Mt. Mitchell is a one way toll road. The traveling goes upwards in the morning and downwards in the afternoon. The road was made partly on the bank of an abandoned logging railroad. It was very steep for the first few miles but the rest of the way the ascent was more gradual, winding high up along the eastern slope of the Black Range, circling around the Pinnacle and skirting Potato Mountain and Clingman's Peak to Camp Ellis on Mt. Mitchell, about 700 feet below the summit. Behind Mt. Mitchell, 6,790 feet high, rise the Black Brothers,

slightly lower. We ate lunch at the inn and climbed the peak in the afternoon. On the top is the grave of Professor Mitchell, who lost his life going down the mountain, where he had been trying to ascertain definitely its altitude. Behind the summit is the warden's log-cabin. Both slopes of Mt. Mitchell have been covered by spruce forests, which were the most extensive in the whole Alleghanies. Now very little is left. For years logging had been carried on by private companies and during the war the business was taken over by the United States Government, using the lumber for ships and aeroplanes. The new growth consists mostly of blackberries and choke-berries, the latter a form with very long narrow peach-like leaves. These slopes constitute now a United States Forest Reserve, while the balsam-covered top of Mt. Mitchell is a state park. On the reserve the government has begun replanting, mostly Norway spruce, which seems to succeed better than our native species.

In the evening we camped on the old site of the logging camp east of the top and northeast from Camp Ellis. We botanized the following day along the eastern slope of Mt. Mitchell and the mountain south thereof. Among plants collected may be mentioned: *Cuscuta rostrata, Rudbeckia laciniata, Rubus canadensis, Ranunculus acris, Eupatorium maculatum, Hypericum graveolens* and a related new species, the beautiful red turtlehead (*Chelone Lyonii*), *Solidago glomerata,* and *Aster divaricatus.* On the following day we descended the slope below our camp. At first we passed through spruce wood, which had not been touched by the woodman's axe. Later, the trail brought us into the hardwood, consisting at first mostly of birch (*Betula alleghanensis*) and beech (*Fagus latifolia*), later of maple (*Acer carolinianum* and *A. spicatum*), and then of chestnut and oak. Among the undergrowth may be mentioned *Ophrys Smallii, Peramium ophioides, Hydrangea arborescens, Robinia fertilis, Diervilla sessilifolia,* etc.

On the 17th, we attended to our presses in the forenoon and in the afternoon moved our camp to the spring on the northeast side of the Pinnacle. Before supper I made a short stroll below our camp and after the meal, I went up into the woods above the road to see if I could find any trail to the top. As this side of the mountain was untouched by both axe and fire, the trees were large and in most cases the undergrowth sparse and the climbing

was easy. I struck a trail which led up towards the summit. I followed this trial, the woods became lower, and I could see that I approached the top. I then undertook a foolhardy thing. I decided to gain the summit only in order to brag to my companion over my achievement. When I reached the top, the sun had set and before I had retreated down into the tall forest it was pitch dark and I had to feel my way down to the road. In the forenoon the following day we climbed the Pinnacle again and descended along the northwest ridge, connecting the Pinnacle with Potato Mountain. On the west slope forest fires had destroyed the wood.

The Alleghanian hardwood forest ascends to near the top of the Pinnacle. Sprucewood was found only in patches; only the very summit was covered by Ericaceous and Vacciniaceous shrubs, as *Rhododendron, Kalmia, Vaccinium pallidum,* etc. Among the trees below the camp I found a new species of *Stachys, Veratrum viride, Phlox glaberrima, Campanula divaricata,* etc. Along the road there was a great display of St. John's-wort, *Hypericum prolificum, H. graveolens,* and the new species mentioned above. In the woods on the peak, we found *Pedicularis canadensis, Convolvulus americanus, Monarda media, M. clinopodia, Lilium superbum, Veratrum parviflorum, Thermopsis fraxinifolia, Viorna Viorna,* and *Campanulastrum americanum.*

While we camped near the Pinnacle spring a party of young people passed our camp on a hike to Mt. Mitchell. Among the party was Professor Davis, of Davidson College, who told us that he spent his summers as one of the councillors of Sequoyah Boy Camp near Beech at the foot of the Craggy Mountains. He stated that the Craggies were well worth seeing and of botanical interest, and was sure that we could get accommodations at the camp. We later followed his suggestion.

In the afternoon of July 18 we drove down and continued our journey to Asheville, where we stayed over two nights. During the stay we had repairs made on the automobile, laid in supplies, called on Mr. Costian, of the United States Forest Service, and Mr. Beadle, of the Biltmore Estate. The former also advised us to visit the Craggies, gave us information about the Alleghanian forests, etc. He also was of the opinion that the balsam of West

Virginia is *Abies balsamea,* though some state botanists have reported it as *A. Fraseri.* With Mr. Beadle, who fifteen or twenty years ago did so much for the knowledge of the flora of North Carolina, we had a very interesting chat for an hour or more. He told us about several places where he unexpectedly had found Canadian Zone plants even at low altitude. Unfortunately we had time only to visit one of these places but did not find what we sought.

Our next field of exploration was the Craggy Mountains. We had our headquarters in one of the log-cabins of the Sequoyah Camp. The camp consisted of an open log dining hall with a reading room in one end and kitchen in the other, two houses for the director, Mr. Johnson, and his assistant, a store-house, and several log-cabins holding four to six boys and a councillor each. Further there was a fine spring of the purest water, a swimming pool, dammed up in the brook, tennis and ball grounds, etc. We rented the "useful" horse of the camp to carry our tent, blankets, and a little provision for a day and a half stay on the mountain. Professor Davis acted as our guide and took us far enough so that we could find the first camping place along the trail near a very small spring.

The flora of the high ridge of the Craggies I would classify as belonging to the Canadian zone, although there was no spruce wood. The trees were rather scattered and consisted, on the top of the ridges, of beeches (*Fagus grandifolia*) and birch (*Betula alleghaniensis*), on sides more mixed with maple, flowering dogwood, and mountain ash. In one place we saw a few trees of buckeye (*Aesculus octandra*). Between the groves there were large stretches of grassland and on the summits of the crags grew Rhododendron, Kalmia, and hawthorn. Among herbaceous plants may be mentioned *Cynthia montana, Rudbeckia monticola, Coreopsis pubescens,* and *Phlox glaberrima.* The woods nearest the camp were more varied and truly Alleghanian in nature, as oaks, hickories, chestnuts, plane-trees, tulip-trees, and willows were added. Some interesting plants among the undergrowth may be mentioned, as *Azalea lutea, Diphylleia cymosa, Koellia montana, Aureolaria laevigata, Ligusticum canadense, Lilium superbum,* etc.

On the 22nd of July we traveled through Asheville to the foot of Mt. Pisgah. The road up the mountain was originally built

by the late Mr. Vanderbilt up to his summer home, still occupied occasionally by Mrs. Vanderbilt. It is now under the control of the United States Forest Reserve, and has been continued and connected with the state roads south of the mountains. It is, as at Mt. Mitchell, a one-way road, with the traffic going up in the forenoon and down in the afternoon. Only a short distance between the Vanderbilt estate and Frying Pan Gap cars were allowed to run either way. We therefore had to stop at the base over night.

On July 24 we drove back to the restaurant nearly opposite the Vanderbilt estate, where we left the car and ascended Mt. Pisgah on foot. An old woodroad led through the Alleghanian hardwood. The only tree of interest we found here was *Amelanchier intermedia.* The top of Mt. Pisgah belongs to the Canadian life zone, though none of the northern trees were found, and most of the shrubs and many of the herbaceous plants are characteristic of the southern mountains. Such shrubs were *Diervilla sessilifolia, Hypericum Buckleyi,* and *Clethra acuminata.* The only northern one was *Salix humilis.* Among herbs may be mentioned *Parthenium integrifolium, Cirsium muticum, Angelica villosa, Stenanthium gramineum, Zizia Bebbii,* and *Rudbeckia monticola.* The summit was mostly covered by Ericaceous and Vacciniaceous plants as *Arsenococcus ligustrinus, Pieris floribunda, Azalea viscosa, Rhododendron catawbiense, Vaccinum vaccilans,* and *Galussacia baccata.*

On July 25 we botanized around the camp, mostly on Big Baldy, a high knoll, almost devoid of trees, between Frying Pan Gap and the Vanderbilt estate. It is mostly covered by rhododendrons, other Ericaceous shrubs and blueberries. Herbaceous plants collected there were of a great variety, as *Blephariglottis ciliaris,* and *B. grandiflora, Stenanthium gramineum, Veratrum parviflorum, Lilium superbum, Aletris farinosa, Chrysopsis Mariana, Helianthus atrorubens, H. saxicola, Parthenium integrifolium, Angelica villosa, Thaspium barbinode, Houstonia tenuifolia,* and *H. purpurea.* In a grove, consisting mostly of *Quercus maxima, Q. borealis,* and *Crataegus macrosperma,* we found a tree, which I took to be *Quercus marilandica × maxima.* Near the spring we found *Dioscorea glauca* and *Corylus rostrata.* The blueberries were very common; *Vaccinium pallidum, V. vaccillans,* and *Polycodium candicans* were the most common.

On July 26 we tended presses, packed plants for shipment, wrote letters, etc., in the forenoon, and descended the mountain, staying over night at Mr. Brumbeloe's. On the 27 we drove to Asheville, had small repairs on the car made, shipped boxes, laid in supplies, drove out to Naples, collected along Mud Creek for two hours, and returned to Asheville. The only plants of interest collected were *Peltandra virginica, Arundinaria tecta,* and *Sabbatia campanulata.* The following day we started on our home run, drove through Weaverville, Burns, Cranberry, Elk Park, N. C., Roan Mountain, Elizabethtown, to Johnson City, Tenn., where we camped at the city tourist camp. The next day we passed through Bristol (the roads were all good, the bad places had been repaired), Abington, to Chilhowie, where we turned off to the southeast to Konnarock. I have already related our visit here. On returning on August 1st to Chilhowie we had a leaking radiator repaired, whereupon we resumed our journey home, camped over night near Christianburg, visited the Natural Bridge, camped at the tourist camp at Lexington, broke the main shaft and were laid up for a day at Fairfield, camped at the Endless Caverns, Va., Kutztown, Pa., and arrived at New York on August 10.

Summary: Our explorations were carried on mostly in the upper part of the Middle Temperate Zone, or what Merriam has called the Transition Life Zone, which in eastern United States is characterized by hardwood, as oaks, hickories, chestnut, maples, buckeyes, plane-trees, tulip-trees, etc. In this article I have called these woods Alleghanian forest. In the lower part on the east side of the mountains, the hardwoods are often intermixed with pines, hemlocks, and red cedars. The undershrubs consist of *Rhododendron maximum* and *Kalmia latifolia,* many blueberries, elders, and viburnums. Only the highest peaks reach into the colder Temperate or Canadian Zone, characterized around the Great Lakes by white pine, Norway pine, canoe-birch, and aspen. Beeches and yellow birches are common to both the Middle and Colder Temperate Zone, so are also some maples. The characteristic trees of the Cold Temperate Zone in the Alleghanies are red spruce and the balsams, *Abies balsamea* in the northern and *A. Fraseri* in the southern. The shrubbery consists of Alder, *Kalmia, Menziesia,* and blueberries, and in the

southern mountains, besides these, *Rhododendron catawbiense* and *Dendrium Lyonii.* In northern West Virginia the Canadian Zone was met only at an altitude of nearly 4,000 feet or more, in southern Virginia at 5,000 feet altitude, and in Tennessee and North Carolina at 6,000 feet. Of the mountains we visited, the following reached this zone: Spruce Knob and Panther, W. Va.; White Top, Va.; Roan Mountain, Tenn.; Grandfather, Mt. Mitchell, Mt. Pisgah, Big Baldy, and Craggy Mountains, N. C., though spruce and balsam were lacking on the last two. Snowy Mountain, W. Va., and Shenandoah Mountain and Peaks of Otter, Va., did not reach this zone. Though we passed through some valleys which had a flora which could be counted as belonging to Warmer Temperate or Carolinian Zone, we collected at only one such place, Mud Creek, near Naples. The only strictly Carolinian plant we collected was the cane, *Arundinaria tecta.*

P. A. RYDBERG.

TREE-FERNS IN PORTO RICO

Among the most beautiful natural features of Porto Rico are twelve different kinds of tree-ferns, three of them growing nowhere else. They mostly inhabit mountain forests, difficult of access, but several kinds may be seen from points on the wonderful system of driving roads (carrateras), growing on steep slopes, in valleys and on banks. On the military road in the vicinity of Las Cruces, between Caguas and Cayey, two species occur in considerable abundance in full view from the road (see Jour. N. Y. Bot. Gard. **7**: 137 *f. 11.* 1906); this is, perhaps, the most easily accessible point for the visitor from the north to see them, as it is only about one and one-half hours drive from San Juan, at an elevation of about 1,500 feet; you may here get close to these big ferns by some rather stiff walking on the steep slopes. The larger of the two species forms a trunk thirty feet or more in height and has a magnificient crown of large divided leaves.

Another kind may be seen close to the road in the vicinity of Barranquitas, about two hours drive from San Juan, elevation about 2,000 feet, and there are many points on the high mountain roads, more distant from San Juan, where these elegant plants grow in greater or less abundance.

But to see them in their full glory, you must reach the higher mountain forests, on horseback or on foot. Several kinds inhabit the Luquillo National Forest near the eastern end of Porto Rico, reached on a horse from Mameyes in about two hours, reaching elevations from 2,000 to over 3,000 feet. Several kinds inhabit also the mountain forests near and above Maricao near the western end of the island. Maricao is at the end of a stone driving

FIGURE 4. A rare Porto Rican tree-fern, *Cyathea dryopteroides*, growing in Conservatory Range No. 2.

road, about an hour from Mayagüez, and then you must ride or walk.

While most of the kinds grow best at the higher elevations, one of them is luxuriant at sea-level and is planted in many gardens and yards of houses at Santurce and other suburbs of San Juan, and lends itself beautifully to decorative tropical planting.

The rarest of the Porto Rico tree-ferns, and one of the very rare ferns of the world, grows in the forest on Mt. Cerrote, a few miles from Adjuntas at an elevation of over 2,500 feet. It was

discovered there by Dr. N. L. Britton and the late Mr. Stewardson Brown in 1915, while studying the vegetation of this mountainous region. This species (*Cyathea dryopteroides*) forms a trunk only two or three feet high, with peculiar leaves about three feet long. At the time of discovery a young plant was obtained and successfully transplanted to The New York Botanical Garden, where it has grown slowly but vigorously and is now a beautiful specimen, and one of the most highly prized rarities of the tropical fern collection in Conservatory Range No. 2.

Complete descriptions of all the ferns of Porto Rico will soon be available to the student through the publication by the New York Academy of Sciences of the third part of the sixth volume, Scientific Survey of Porto Rico and the Virgin Islands, now in press. These descriptions are contributed by Dr. William R. Maxon, of the Smithsonian Institution; his investigation was made possible by the large collections of Porto Rico ferns at The New York Botanical Garden and the United States National Herbarium. Except for Jenman's work upon the ferns of Jamaica, published about 30 years ago, this contribution is the only descriptive account of the ferns of any of the West Indian Islands.

N. L. Britton.

MYCOLOGICAL WORK IN BERMUDA

Doctor N. L. Britton, Director-in-Chief:

Sir:—With your permission, I sailed, in company with Professor H. H. Whetzel of Cornell University, on January 9, for Bermuda to continue the study of the fungi begun at your request in 1912. Two weeks were spent on the islands on the former occasion in company with you, the excursion resulting in yielding a number of fungi not known from the islands and several new to science. The results of this work were published in the *Memoirs of The New York Botanical Garden* (**6**: 501–511. 1916), and was the first attempt to study and list the fungi of those islands.

Professor Whetzel spent an entire year in Bermuda, 1921–1922, in the employ of the Bermudian Government, the time being divided between problems in plant pathology and a continuation

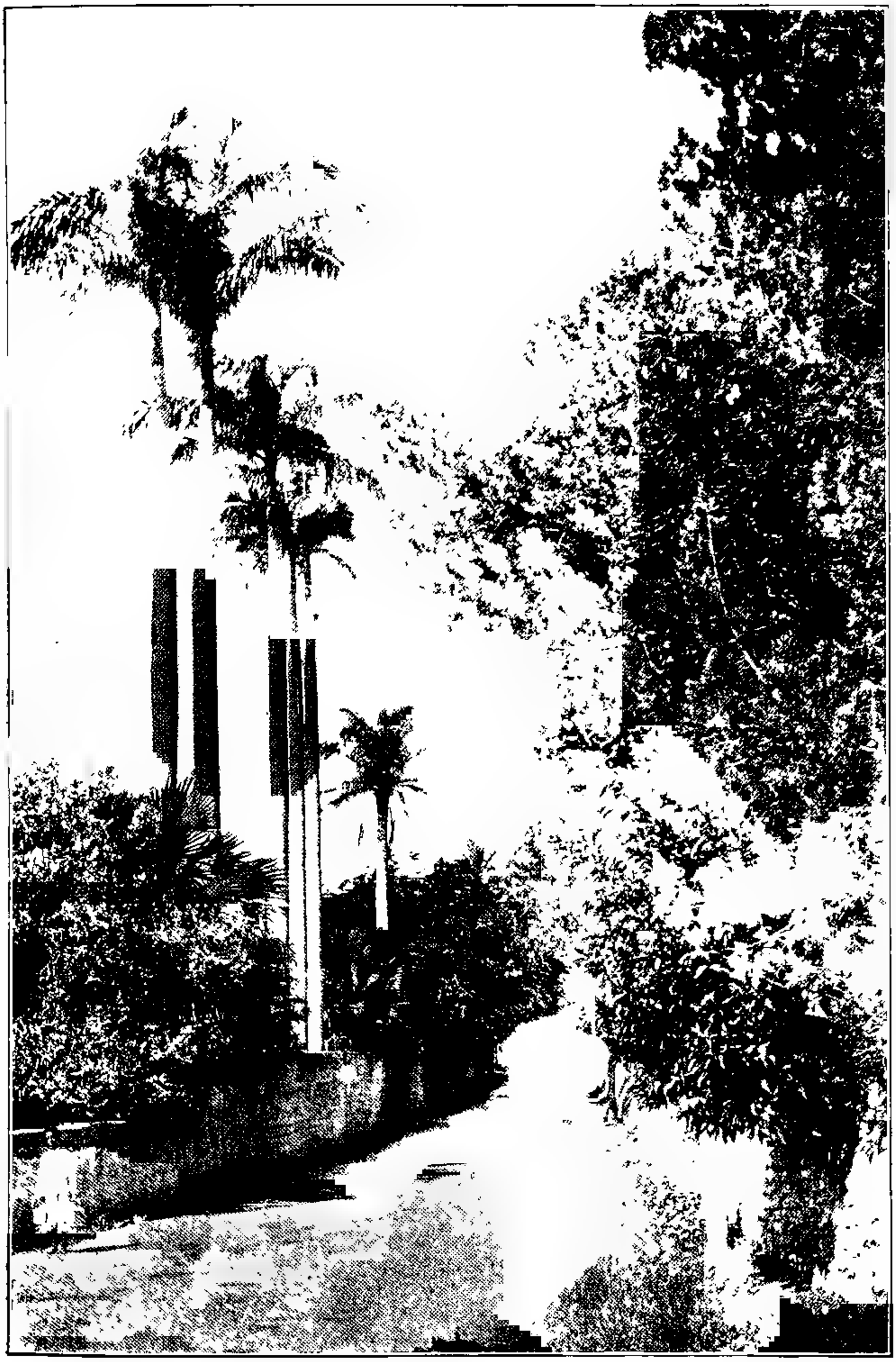


FIGURE 5. Royal palms and Bermuda cedar, near Hamilton, Bermuda.

of the survey of the fungi. His work greatly extended our knowledge of the fungi and it is the intention to publish the complete list at some future time. The present expedition was undertaken with this object in view.

Arriving in Bermuda on January 11, Professor Whetzel was taken to the home of Mr. E. A. MacCallan, Director of Agriculture, while I made my headquarters with Mr. L. Ogilvie, Plant Pathologist, in Paget East, our scientific work being carried on in the laboratories of the Experiment Station at the Public Gardens, where a preliminary microscopic study was made of the fungi, in order to insure the collection of good material.

The first week was spent mainly in the vicinity of Hamilton, during which time both Devonshire and Paget Marshes were visited, each yielding a number of interesting fungi and slime-moulds. One afternoon was spent about Hungry Bay, also with good results. The remaining time was devoted to the Public Gardens and those points within easy walking distance from the Experiment Station. The longer trips were made by bicycle.

On January 18, we changed our base from Hamilton to Harrington Sound, stopping at the Harrington House as on our former visit in 1912. The hotel occupied by us on former occasion had been burned and has recently been replaced by a larger and more modern structure. We were permitted to use one of the adjacent cottages, which gave us excellent facilities for drying and caring for our collections. This part of the island offers especially favorable opportunity for scientific work because of its isolation and the large amount of uncultivated land within close range. Some time was spent about Walsingham Bay, near which was once the home of Tom Moore.

On January 23, we returned to our former locations in the vicinity of Hamilton. During the first three days of the following week, January 25–27, it rained almost continuously except for short periods in the middle of the day, retarding but not entirely stopping our field operations. When we were unable to get out, the time was spent in caring for the collections and writing up the results. January 28 was an unusually fine day and was devoted to the south shore. Here a number of fungi were collected not before known from the islands, including one species of *Lamprospora* known both from America and Europe.

On January 29, we were joined by Mr. Lewcock, an Australian student who has been spending the year at the University of Wisconsin. As previously arranged, Mr. Lewcock came to Bermuda to make observations on a fungus parasite of the prickly-pear cactus, looking toward the possibility of introducing the fungus into Australia to combat the cactus which has overrun more than sixty millions of acres of land there, making it useless. The spread of the cactus there has been so rapid that man is unable to cope with the pest and attempts are now being made to fight it by natural means.

On Monday, February 1, we were invited to attend the Somerset Garden club meeting and speak. The meeting was held at the home of Mr. and Mrs. F. C. Misick with an attendance of about thirty-five, for the most part former Americans, now residents of the so-called American colony. As first speaker, I gave a brief discussion of my mission to the islands, dealing with the mycological phases of the subject. Professor Whetzel followed with a discussion of the important plant diseases of the islands and the means of control. Mr. Lewcock discussed the prickly-pear difficulty in Australia, and Mr. MacCallan added a few words, after which a social time was enjoyed. It rained during the entire day so that no opportunity was afforded for field work.

On Tuesday, February 9, Mr. Thos. Godet kindly offered to take us in his motor boat to a number of the islands in the harbor to observe the effect of the fungus blight on the prickly-pear cactus. The most interesting was Grace's Island, where the cactus had been almost wiped out by the disease. While Mr. Lewcock was making the necessary observations, I took the opportunity to collect fungi and was surprised to find a number not before observed from the islands, among them a *Geaster,* a *Tylostoma,* and a *Poronia,* the last being of especial interest.

The remaining time was spent in drying and arranging material for shipment and getting ready to sail for home. More than three hundred collections were made. These will be sent first to Cornell University, where they will be separated and a portion of each collection returned to the Garden. When this collection is finally disposed of, our knowledge of the fungi of Bermuda will be more complete than that of any of the islands of the American tropics or subtropics, with the possible exception of Porto Rico.

Respectfully submitted,

FRED J. SEAVER.

LILIES AT THE INTERNATIONAL FLOWER SHOW

Lilies in considerable number and variety were on display in the various exhibits of the Thirteenth International Flower Show recently held in New York City. There were numerous fine specimens of the Easter Lily and the Madonna Lily in competition for prizes for lilies in pots or as cut flowers. But the largest displays of lilies were the two entered for the open class competition for collection of lilies in pots covering not less than 100 square feet. The first prize was awarded to Mrs. Harold I. Pratt, Mr. Frank B. Johnson, Superintendent, Glen Cove, L. I. This collection of a total of about 125 plants included the following named species: Madonna Lily (*L. candidum*), Easter Lily (*L. longiflorum*), Golden-banded Lily (*L. auratum*), Showy Lily (*L. speciosum*), Nankeen Lily (*Lilium testaceum*), Candlestick Lily (*L. umbellatum*), and one plant of Henry's Lily (*L. Henryi*). The second prize was awarded to a display by Mr. C. E. Mitchell, Mr. James Ventota, Superintendent, of Tuxedo Park, N. Y. In this exhibit there were plants of the Tiger Lily (*L. tigrinum*), a hybrid lily known as *L. Batemanniae,* Madonna Lily, Showy Lily, Golden-banded Lily and Easter Lily. Although somewhat larger in point of number of plants, these two displays were less attractive and effective than were the two collections of lilies on display in 1924. The 1925 exhibit was missed by the writer on account of absence in Florida. There was, it would seem, too large a proportion of Easter and Madonna lilies. The number of any one lily in such a display should perhaps be limited.

The New York Botanical Garden had on exhibition, purely as an educational display, 24 plants of the Regal Lily (*L. regale*), 12 plants of the Orange Lily (*L. croceum*) and 2 plants of *L. davuricum,* all in splendid bloom. The bulbs from which the Regal Lilies were grown were donated by Mr. C. P. Horsford of Charlotte, Vermont, and the bulbs for the others were supplied by Mrs. Mortimer J. Fox. It happened that there were no other plants of these lilies on display. This was a matter of some surprise, as the Regal Lily is an excellent lily, easy to force, and rapidly coming into popular favor. A Regal Lily in bloom reared from seed at The New York Botanical Garden was included in the display and also pans of young seedlings of Henry's Lily, the Showy Lily and the Regal Lily.

A. B. Stout.

CONFERENCE NOTES

A regular monthly conference of the Scientific Staff and Registered Students of The New York Botanical Garden has been held for each of the months of December, January, and February, with programs as follows:

For December,

"The morphology of pollen with reference to the classification of plants," by Mr. R. P. Wodehouse.

For January,

"Seedling leaf-characters of the common and Japanese Barberry," by Mr. Clarence Moore.

"Botanizing in the higher Alleghany Mountains," by Dr. P. A. Rydberg.

For February,

"Some recent accessions to the living plant collection," by Mr. Kenneth R. Boynton.

"Recent exploration in the Gulf States," by Dr. John K. Small.

Nearly all of the various subjects presented at these conferences have been or will be printed as special articles in the *Journal of The New York Botanical Garden.*

A. B. STOUT,
Secretary of the Conference.

NOTES, NEWS, AND COMMENT

"'America, the Beautiful' would be carpeted from coast to coast with the blue-eyed Fringed Gentian if the thousands of flower-lovers writing to The New York Botanical Garden could be given the seeds they seek," says an Associated Press dispatch sent out from New York under the date of February 15. In the number of the *Journal of The New York Botanical Garden* for November, 1923, Dr. George F. Norton, impressed by the fact that the Fringed Gentian was becoming scarce, generously offered to send seeds to any one who would enclose a stamp with the application and plant the seeds properly. The offer was given publicity by a few local newspapers and about 580 packages of seed

were sent out, as reported by Dr. A. B. Stout in the *Journal* for February, 1924, and by Dr. Norton in the *Journal* for February, 1925. In the *Journal* for last November Dr. Norton repeated the offer. This time it was copied by *The New York Times, The Youth's Companion,* the *National Plant, Flower, and Fruit Guild Magazine,* a science-teachers' magazine, and by local papers in Pennsylvania, West Virginia, Kentucky, North Carolina, South Carolina, California, and Florida, and the glad tidings even reached England, Ireland, France, Germany, the Philippine Islands, and Australia. At the crest of the flood the applications reached a hundred a day. More than 2,000 requests for seeds were received in all, but when about 350 packages of seed had been sent out, the supply was unfortunately exhausted. To late applicants, at least to those that enclosed a stamp, a form letter was sent, expressing regret that there were no longer any seeds for distribution. As the Associated Press dispatch put it, "an idyl was wrecked by advertising." However, the letters of most of the unsatisfied applicants have been preserved and it is possible that their wants may be met at some later time.

Meteorology for March. The total precipitation for the month was 3.08 inches. The maximum temperatures recorded for each week were 51° on the 1st, 46° on the 10th, 59° on the 20th and *69° on the 25th.* The minimum temperatures were *10° on the 6th,* 15° on the 14th, 21° on the 16th, and 25° on the 28th. Ice disappeared from the middle lake on the 26th. From the time it froze over in the autumn until this date, there was a continuous sheet of ice, unbroken.

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A **library** of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

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I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

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JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

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VOL. XXVII MAY, 1926 No. 317

FURTHER BOTANICAL INVESTIGATION IN PORTO RICO

TO THE SCIENTIFIC DIRECTORS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen:—In continuation of botanical investigations in Porto Rico, I was occupied there from January 25th to March 25th, 1926, as previously authorized by the Board of Managers, accompanied and aided by Mrs. Britton, taking part in the "Scientific Survey of Porto Rico and the Virgin Islands," which has been in progress for several years under the auspices of The New York Academy of Sciences, in coöperation with the Insular Government of Porto Rico, The American Museum of Natural History, Columbia University, and our own institution, with aid from many students from other organizations and from residents of Porto Rico, St. Thomas, and St. Croix. This survey has been prosecuted in the fields of Geology, Palaeontology, Botany, Zoology, Anthropology, and Archaeology, and has contributed much to the knowledge of the natural history of the West Indies; the botanical part has mostly been contributed by The New York Botanical Garden, through members of its staff and assistants, and is still in progress after much preliminary publication of results. Four volumes of the final reports of the Survey have been assigned to Botany (Volumes 5, 6, 7 and 8); of these, Volume 5 (Seed Plants) is published in four parts; of Volume 6, Parts 1 and 2 (Seed Plants) are published, with Part 3 (Seed Plants, Ferns and Fern allies) in press, and Part 4 (Mosses and Hepatics) in preparation; Volume 7 is reserved for Plant Ecolongy and Palaeobotany (in preparation); Volume 8, Part 1 (Fungi) is in press; Parts 2, 3, and 4 are reserved for Algae and Lichens and for a complete index to the four botanical volumes.

Our time during the two months' period was given to aiding several parts of the Survey and to supplemental work bearing upon our own previous investigations of wild and cultivated plants, this occupation leading us to many different localities. The extensive plantations of the Porto Rico Department of Agriculture and Labor at the Insular Agricultural Experiment Station, Rio Piedras, and at the Plant Propagation Station, Trujillo, as also those of the Forest Service, Rio Piedras, and of the Federal Agricultural Experiment Station, Mayaguez, were restudied, and notes were made upon the growth of many kinds of plants introduced from all parts of the tropics as useful or ornamental species; many interesting additions have been made to these collections during the past year and, all together, the representation of exotic plants in Porto Rico, is now more comprehensive than anywhere else in tropical America and it must compare well with establishments in the Old World tropics. The distribution of exotics from these goverment plantations to gardens and forests, as well as plants brought in by indivduals, gives continuously greater diversity and interest to private gardens and grounds and tends to diversify agriculture and forestry. Forest protection and reforestation are beginning to show important results, but the organization and support of the Forest Service is not yet broad enough to meet the needs of the situation which has been brought about by the elimination of forests in former years. The costs of lumber and of charcoal are very high, and the headwaters of streams and rivers require the restoration of trees in large numbers. Recent legislative encouragement of the extension of cafetals, requiring trees for the shading of the coffee plants, may operate to reclothe bare mountain areas and should stimulate coffee production, but will not materially increase the amount of wood required for charcoal, the fuel which must always be depended upon for domestic use in Porto Rico.

We made additional studies in several of the small forests areas remaining at lower elevations. In swampy woods near Playa de Humacao the dominant tree is *Pterocarpus officinalis,* here known as Palo pollo, not before seen by us in Porto Rico and evidently rare; it is of the Pea Family, with pinnate leaves and panicled flowers and very characteristic round flat margined pods, each with a single seed. In coastal woods at La Sardinera near Dor-

ado, previously studied, we obtained the flowers of the Guayabota (*Diospyros Ebenaster*) from a tree which had yielded us specimens of the fruit on a former occasion; this tall tree is of the Persimmon Family; one of the most interesting of all Porto Rico trees and one of the very rarest exists in this interesting forest; it is *Anamomis fragrans* of the Myrtle Family, or a closely related species, with smooth light-colored trunk and branches, its small bright green oval leaves delightfully odorous; we obtained specimens of its foliage, but the tree was not in blossom on either of two visits to these woods and flowers or fruit are required for an accurate determination of the species botanically, and these we hope to obtain later in the year, through the kindly interest of Miss Clara Livingston, owner of the property.

Another rare tree of Porto Rico, Cobana negra (*Stahlia monosperma*) of the Senna Family, has recently been observed by the Forest Service and by others at several points along the coast and is not quite so near extinction as was feared. Seeds were obtained from near Boqueron and germinated at the forest nurseries, where we saw, with pleasure, many young trees ready for transplanting; this species is of especial interest as inhabiting Porto Rico only, and its generic name fittingly commemorates Dr. Agustin Stahl, the most distinguished naturalist of the island; its hard, nearly black wood, is highly valued.

We made collections of ferns at several localities, to aid the studies of Dr. W. R. Maxon, of the Smithsonian Institution, whose descriptions of these plants will appear in Part 3 of Volume 6 of the Scientific Survey soon to be published; other fern specimens from the higher mountains, were contributed by Professor E. E. Dale of the University of Porto Rico.

Special attention was given to collecting rock-inhabiting lichens, very abundant on the limestones at many places, for study by Professor Bruce Fink of Miami University and other lichenologists.

A study of the Plant Ecology of Porto Rico, based upon the botanical and geological results of the Scientific Survey already published, and the climatological investigations of the United States Weather Bureau, was undertaken in January 1926 in coöperation with the Porto Rico Department of Agriculture and Labor. Dr. H. A. Gleason, of our Garden staff, was permitted

to accept an invitation from Hon. Carlos E. Chardon, Commissioner of Agriculture and Labor, to prosecute this investigation, in the field, for a period of about three months, with Dr. Mel T. Cook, Botanist of the Porto Rico Government. Drs. Gleason and Cook traveled widely through the island during February and March, making extensive collections and voluminous notes and will continue this work during April. I aided them by determining several hundred species, while in Porto Rico, and will continue this aid when Dr. Gleason returns to New York with the collections made. The results of this ecological investigation are planned for publication, illustrated by many photographs, in Volume 7 of the Scientific Survey, and will also be available for publication in Porto Rico. Dr. Gleason's preliminary report will be appended to this narrative.

Little is as yet known of the extinct vegetation of Porto Rico. A few specimens of fossil plants were obtained some years ago by Don Narciso Rabell, of San Sebastian, while forming his extensive and valuable collection of fossil molluscs and other animal remains from the Tertiary strata in the vicinity of that town, and a few others were collected by the geologists Bela Hubbard and E. T. Hodge. Information drawn from this fragmentary material was recently brought together by Dr. Arthur Hollick, Paleobotanist of our Garden staff, and after consultation with Señor Rabell, in February, I visited one of the localities indicated by him, at the Falls of the Collazo River, with Mr. W. D. Noble, who on this occasion, as previously, has contributed greatly to our prosecution of geological and mineralogical studies.

We found that certain clay layers of the formation designated by the geologists San Sebastian Shales, were crowded with the remains of plants, including leaves, fruits, and other fragments; after excavating and selecting a number of specimens we concluded that the subject was of such importance that expert assistance was needed; I therefore cabled to New York, asking Dr. Hollick to come to Porto Rico for the purpose of selecting specimens, and as the friable matrix rapidly disintegrated in drying, to make drawings promptly. Dr. Hollick arrived on March 1st and gave continuous attention to collecting, drawing, and preserving specimens until coming north with me on March 25th, aided by Mr. Noble and by me. We ascertained that a method of pre-

serving similar fossils, by saturating the pieces of clay with a solution of paraffin in benzol, already known to me, was quite effective, and as the time at command was insufficient for Dr. Hollick to make drawings of many of the specimens obtained, we packed the whole collection and, to avoid breakage, brought it north with us as personal baggage for further study; it is the most important addition to our museum of paleobotany made in many years, and furnishes the most information yet obtained about the ancestors of the West Indian Flora.

Other localities, which we visited but had not time to explore, may, ultimately, supply much additional information and material. Dr. Hollick's account of his work while in Porto Rico is appended to this report, and his detailed descriptions and drawings of the fossils are intended for publication in Volume 7 of the Scientific Survey.

We were glad to be of some service to Mr. H. E. Anthony, Curator of Mammalogy in the American Museum of Natural History, who came to Porto Rico in February with his assistants, Mr. and Mrs. Goodwin and Mr. Ottley, to continue his important studies of Porto Rico mammals, living and extinct.

Mr. and Mrs. Robert Hagelstein of New York were in Porto Rico during our visit, engaged in the collection and study of diatoms, an order of organisms as yet little known from there, but which proved to be abundant and diverse; they accompanied us on several occasions, and the results of this study will be a noteworthy contribution to Algology, planned for publication in Volume 8 of the Scientific Survey. Mr. Hagelstein also made collections of slime moulds, records of which will be available.

We gratefully record advice, aid, and hospitality received from His Excellency Governor Horace M. Towner and Mrs. Towner; Commissioner of Agriculture Carlos E. Chardon and Mrs. Chardon; Hon. Jaime Baguey, Assistant Commisioner of Agriculture, and Señora Baguey; Commissioner of Education, Juan T. Huyke; Mr. Otis W. Barrett, Agricultural Director, and Mrs. Barrett; Señor F. A. Lopez, Director of the Insular Agricultural Experiment Station, and Señora Lopez; Mr. W. P. Kramer, Chief of the Forest Service and his assistants, Messrs. C. L. Bates and D. V. Brush; Mr. C. H. Crisson, Agent of the All America Cables at San Juan, and Mrs. Crisson; Mr. Arthur Noble, British Consul,

his brother Mr. W. D. Noble and the Misses Noble, of Condado; Mr. D. W. May, Director of the Mayaguez Agricultural Experiment Station, and Mrs. May; Mr. T. B. McClelland, Horticulturist of the Mayaguez Station, and his mother; Professor H. T. Cowles of the College of Agriculture and Mechanic Arts, Mayaguez; Professor F. D. Kern, Dean of that College; Professor J. S. Dexter, of the University of Porto Rico, and Mrs. Dexter, Professor E. E. Dale, also of the University; Dr. J. W. Harris, President of the Polytechnic Institute of Porto Rico, at San German, and Mrs. Harris; Mr. Samuel Marvin of Villalba, and Mrs. Marvin; Mr. Walter Mackay-Jones and Mrs. Mackay-Jones, also of Villalba; Mrs. F. T. Maxwell of Ensenada; Don Andres Oliver of Arecibo, and Señora Oliver; Don Rafael Gandia of Miramar; Mr. B. F. Murphy of Villa Leon, and Mrs. Murphy; Miss Clara Livingston of La Sardinera; Mr. Herman Wirsching of Ponce; Mr. and Mrs. Grier, of Rio Piedras; Mr. F. M. Pennock, of Sabana Llana, and from many other residents of Porto Rico and many visitors from the North.

Respectfully submitted,

N. L. BRITTON,
Director-in-Chief.

PALEOBOTANICAL EXPLORATION IN PORTO RICO

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: -I have the honor to report as follows upon recent field work in Porto Rico and results attained in connection with it:

I arrived at San Juan on March 1 and returned to New York on March 25. During the time represented by that interval five days were spent in the field, exploring and collecting, and the remainder of the days were occupied in sorting the specimens collected; treating them with a solution of paraffin dissolved in benzol, in order to prevent them from disintegrating; and making drawings of certain ones that appeared to be of greatest interest.

Most of the material, consisting of plant remains and a few associated molluscs and other animal organisms, were collected at four stations in the ravine of the Collazo River below the Lares-

San Sebastian road, where the road crosses the ravine by means of a bridge. These stations are respectively designated A, B, C, D, in my note book, and the specimens from each station are labeled accordingly. This is the locality described by Dr. Bela Hubbard in his report on The Geology of the Lares District, Porto Rico.[1]

About 200 specimens were collected, probably representing approximately 150 species of fossil plants, 44 of which have already been drawn as subjects for specific description and illustration.

The fossil-bearing deposits consist of a series of thinly bedded clays, fresh and brackish-water limestones, and marls. The entire series was designated the San Sebastian shales by Berkey, the Collazo shales by Reeds, and the Rio Collazo shales by Maury.

The series was determined by Doctor Maury[2] and by Doctor Hubbard[3] from a study of the molluscan remains, to be Tertiary in age, and the general facies of the flora confirms this determination.

In connection with the work of collecting we were indebted to Mr. W. D. Noble, of San Juan, for valuable and much appreciated assistance. During one day we were also favored by the presence and assistance of Señor Martin Ibañez of Corozal.

We also visited and made a somewhat hasty examination of an exposure of the San Sebastian shales in the ravine of Half Moon (Media Luna) Creek, a small watercourse parallel with and a short distance to the east of the Collazo ravine. This locality is designated Station E. A bed of lignitic debris was found here, but no specimens that were capable of identification. Further exploration of the exposure, however, ought to bring better material to light. Incidentally, also, we made an effort to locate the station mentioned by Hodge[4] (loc. cit., pp. 192–193) as having yielded fossil plants of Cretaceous age, but without satisfactory results. We discovered, however, between kilometer 85 and 86,

[1] Scientific Survey of Porto Rico and the Virgin Islands, vol. 2, pt. 1. 1923. See chapter on "The San Sebastian Shale," pp. 39–42, text fig. 18.

[2] Maury, Carlotta J. Tertiary Mollusca from Porto Rico: op. cit., vol. 3, pt. 1. 1920.

[3] Hubbard, Bela. Tertiary Mollusca from the Lares District, Porto Rico: op. cit., vol. 3, pt. 2 1921.

[4] Hodge, E. T. Geology of the Coamo-Guayama District: op. cit., vol. 1, pt. 2, pp. 192, 193. 1920.

on the military road southwest of Aibonito an exposure of layers of hard ferruginous shale, in which were obscure impressions of stems of plants and a well-defined impression and cast of a mollusc. The latter may be the means of determining the geologic age of the shale. This locality is designated Station F in my note book.

In conclusion, it may be of interest to note that, until this year the total known, or recorded fossil flora of the entire West Indies amounted to approximately 110 species (including 23 from Porto Rico); hence we have, as a result of this one month's work, from Porto Rico alone, about 40 species more than was previously recorded from the West Indies as a whole.

Respectfully submitted,

ARTHUR HOLLICK.

APRIL 12, 1926.

ECOLOGICAL STUDIES IN PORTO RICO

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir:—Pursuant to arrangements made between you and Hon. Carlos E. Chardon, Commissioner of Agriculture and Labor of Porto Rico, I sailed from New York January 14, 1926, arrived in San Juan January 18, and at once began an ecological survey of Porto Rico in coöperation with Dr. Mel. T. Cook, Botanist and Plant Pathologist of the Insular Experiment Station. I sailed from San Juan April 30 and arrived in New York May 5, 1926.

During the three and one half months in Porto Rico I devoted from two to five days of each week to field work in various parts of the island and the remaining one to four days were used in the organization of the field data, the preparation of manuscript and the preservation of botanical specimens illustrative of the field work.

Twelve weeks were thus used wholly in ecological research while the thirteenth and fourteenth weeks were used partially in directing Mr. R. Colorado in the preparation of photographs to illustrate the vegetation of Porto Rico, and partially in making supplementary notes, observations, and collections.

Dr. Cook will now continue his coöperative work in Porto Rico by the preparation of a portion of the manuscript for our final

report, while a part of my time will be used for the same purpose here. We shall, of course, make every effort to submit a satisfactory manuscript for publication at an early date. At the same time we shall prepare and submit for publication in Porto Rico, subject to the approval of Commissioner Chardon, a more popular account of our work, as well as a third and briefer statement to be published in Spanish. We trust that by these three means of publication we shall make our results known to the greatest possible number of readers, not merely in the United States and Porto Rico, but throughout the world in general.

It is worthy of note that ecological research has received relatively little attention in any part of the tropics. The principal laws governing the distribution and environmental relations of plants and plant communities have been formulated almost wholly from observations made in the temperate zone. A test of these laws and their confirmation or modification under tropical conditions become matters of the highest scientific interest. At the same time, it is very desirable that there be placed on record a description of the natural vegetation of Porto Rico before it has been completely destroyed or more seriously modified by the activities of man.

The original vegetation of Porto Rico was apparently forest except for some narrow strips adjacent to the coast where excess of salt or of water prevented tree growth. Almost all of the natural vegetation of the island has been destroyed by an increasingly dense population during the last three centuries. At the present time undisturbed areas of forest exist only in the National Reserve of the Luquillo Mountains and in certain parts of the Insular forests.

The coast line of the island is marked by a narrow strip of vegetation not extending inland beyond the influence of saline or other maritime conditions. Nearest the ocean a forest of mangroves is extensively developed; in stagnant, slightly brackish water, a dense forest of Pterocarpus occasionally appears. There are also several areas of shifting sand with the usual types of dune vegetation and some fairly extensive expanses of marshland.

The coastal plain of the north shore is composed chiefly of limestone strata and of soils derived from a disintegration of limestone rocks. It is probable that at least three types of forest

vegetation formerly existed here, but the land is now almost completely under agriculture, or, if still uncultivated, the forest has been destroyed for lumber or fuel. A semi-natural vegetation is still to be found on the steeper slopes of the limestone hills.

The coastal plain of the south side of the land is less extensively developed and because of its arid climate has been less occupied by agriculture. Two or three types of forest vegetation exist, but forest in its completely natural condition can no longer be found. The central mountain mass of Porto Rico, stretching from the eastern end of the island to the western, is also largely under cultivation and virgin stands of forest do not exist except in the forest reserves. We have not been able to differentiate more than one type of forest at the lower altitudes, but two well-marked associations occur above two thousand feet.

The chief environmental conditions affecting the distribution of plant life in Porto Rico include both climatic and geological factors. In the north coastal plain soil seems to be of chief importance and there is a sharp line of demarcation between the associations of the coastal plain and of the mountains. On the southern slope, aridity is of paramount importance. Essentially the same type of plant life occurs over all the dry portion of the island on limestone, shale, serpentine, and other sorts of volcanic soils, and extends from sea level to about 1,500 feet in altitude. The forests of the central portion of the island are strictly limited to volcanic soils and to regions of considerable rainfall.

Respectfully submitted,

H. A. GLEASON.

MAY 6, 1926.

SOME RECENT ACCESSIONS TO THE LIVING PLANT COLLECTION[1]

The additions to the Garden collections during the past year include plants of interest, some of which we have been trying to get for a considerable time. The hardy herbaceous collections have been increased by rare species and genera from foreign

[1] Summary of a report presented at a conference of the Scientific Staff and Registered Students of The New York Botanical Garden, February 3, 1926.

botanical gardens and by those making rock garden subjects, including hardy bulbous plants of the Pacific Coast for which we have not heretofore had accommodations. Also many alpine species from Kew and Edinburgh Botanic Gardens, and from Mr. Henri Correvon of Switzerland.

Our hardy shrub and tree collections also have received some new plants, among others *Coriaria japonica* and *nepalensis*, representing a distinct family of Sapindales, with racemous flowers and berry-like fruits, which are enlarged fleshy corollas of the flower, enclosing the carpels.

Much interesting material is now flourishing in our greenhouses as a result of last year's Porto Rico trip. From the Rio Piedras Forest Station we have *Funtumia elastica*, Lagos Rubber; *Melia Azadirachta*, an Indian tree related to the well-known tree *M. Azedarach; Chlorophora excelsa*, an important African timber; *Swietenia macrophylla*, the Honduras Mahogany; and other important economic trees. We collected seed and have raised young plants of Malay Apple, Rose Apple, Maga, *Gliricidia*, Royal Palm, and many plants from the mountains have been brought in.

Interesting tropical plants were shown at the Conference from Louisenhoj, gardens of Mr. Fairchild on St. Thomas. Among these plants were *Couroupita*, the famous Cannonball-tree; *Holmskioldia sanguinea*, an ornamental shrub with colored calyx shaped like and called the "Mandarin's Hat"; single- and double-flowered forms of the native amaryllis, *Hippeastrum puniceum;* Sour-sop, pudding pipe tree and other interesting fruits and ornamental plants. The most rapidly growing of our new plants is a rare Verbena family vine, *Congea tomentosa*, which is a native of Burma and Malaya. The lavender to purple showy bracts, in long clusters are quite everlasting and decorative. Our plant, which Mr. O. W. Barrett, a distinguished plantsman, allowed us to take away from Porto Rico, is now some 18 feet high and still reaching out. Thirty-six varieties of showy-leaved dracaenas, the gift of Mr. F. M. Pennock, together with gardenias and bougainvilleas, are now thriving in our collections.

K. R. Boynton.

PUBLICATIONS OF THE STAFF, SCHOLARS, AND STUDENTS OF THE NEW YORK BOTANICAL GARDEN DURING THE YEAR 1925

Barnhart, J. H. [Biographical notes:] Jour. N. Y. Bot. Gard. **26**: Alvan Wentworth Chapman, 49; Charles Sprague Sargent, 51; Abram Paschall Garber, 51; Charles Wright, 52; Hermann Wendland, 52; William Turner Thiselton-Dyer, 52. Mr 1925; Abram Paschall Garber, 147; Alvan Wentworth Chapman, 147; George Valentine Nash, 149. Jl 1925.

— — . The history and development of greenhouses. Jour. N. Y. Bot. Gard. **26**: 77–80. Ap 1925. [Abstract of lecture.]

————. Eugene Pintard Bicknell. Jour. N. Y. Bot. Gard. **26**: 88, 89. Ap 1925.

————. Eugene Pintard Bicknell (1859–1925). Bull. Torrey Club **52**: 119–126. 18 My 1925. [Illust.]

————. European influences in American botany. Jour. N. Y. Bot. Gard. **26**: 102–111. My 1925. [Text of lecture.]

————. *Sherwoodia galacifolia.* Addisonia **10**: 15, 16. *pl. 328.* 29 Je 1925.

————. Report of the Bibliographer [for 1924]. Bull. N. Y. Bot. Gard. **13**: 31, 32. 30 Jl 1925.

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Becker, H. W. House plants and their care. Jour. N. Y. Bot. Gard. **26**: 59–61. Mr 1925. [Abstract of lecture.]

Boynton, K. R. The Narcissus collection. Jour. N. Y. Bot. Gard. **25**: 320–322. Issue for D 1924 [1925].

————. *Primula Sieboldii.* Addisonia **10**: 5. *pl. 323.* 29 Je 1925.

————. *Begonia sanguinea.* Addisonia **10**: 7. *pl. 324.* 29 Je 1925.

————. *Pittosporum undulatum.* Addisonia **10**: 9, 10. *pl. 325.* 29 Je 1925.

————. *Zanthoxylum schinifolium.* Addisonia **10**: 11. *pl. 326.* 29 Je 1925.

————. *Begonia Dregei.* Addisonia **10**: 13. *pl. 327.* 29 Je 1925.

————. First blooming of the daffodils. Jour. N. Y. Bot. Gard. **26**: 121–123. *f. 1, 2.* Je 1925.

———— . Flowers for spring gardens. Jour. N. Y. Bot. Gard. **26**: 131, 132. Je 1925. [Abstract of lecture.]

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————. Tulips. Jour. N. Y. Bot. Gard. **26**: 159–161. Jl 1925. [Abstract of lecture.]

————. Flowers for the summer garden. Jour. N. Y. Bot Gard. **26**: 206, 207. S 1925. [Abstract of lecture.]

————. *Acokanthera spectabilis.* Addisonia **10**: 33. *pl. 337.* 7 D 1925.

————. *Mesembryanthemum spectabile.* Addisonia **10**: 35. *pl. 338.* 7 D 1925.

————. *Hydrocleys nymphoides.* Addisonia **10**: 37, 38. *pl. 339.* 7 D 1925.

————. *Dimorphotheca aurantiaca.* Addisonia **10**: 39. *pl. 340.* 7 D 1925.

————. *Lonicera fragrantissima.* Addisonia **10**: 41, 42. *pl. 341.* 7 D 1925.

————. *Maranta Kerchoveana.* Addisonia **10**: 43, 44. *pl. 342.* 7 D 1925.

————. *Malpighia coccigera.* Addisonia **10**: 45, 46. *pl. 343.* 7 D 1925.

Boynton, K. R. & **Friedhof, G.** Planting flower seeds. Jour. N. Y. Bot. Gard. **26**: 61, 62. Mr 1925. [Abstract of lecture.]

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———. *Urena lobata.* Addisonia **10**: 19. *pl. 330.* 6 Au 1925.
———. *Erythrina Poeppigiana.* Addisonia **10**: 21. *pl. 331.* 6 Au 1925.
——— –. *Byrsonima Horneana.* Addisonia **10**: 23. *pl. 332.* 6 Au 1925.
———. *Tabebuia haemantha.* Addisonia **10**: 25. *pl. 333.* 6 Au. 1925.
———. *Barbieria pinnata.* Addisonia **10**: 27. *pl. 334.* 6 Au 1925.
———. *Chamaecrista mirabilis.* Addisonia **10**: 29. *pl. 335.* 6 Au 1925.
———. *Distictis lactiflora.* Addisonia **10**: 31. *pl. 336.* 6 Au 1925.
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——— & **Rose, J. N.** The tree-cactuses of the West Indies. Jour. N. Y. Bot. Gard. **26**: 217–221. O 1925. [Illust.]
——— & **Wilson, P.** Botany of Porto Rico and the Virgin Islands. Descriptive Flora—Spermatophyta (continued). N. Y. Acad. Sci. Survey **6**: 1–158. 14 Ja 1925; **6**: 159–316. 31 Au 1925.
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4 N 1925;—VII. **52**: 373–388. *f. 1–4.* 20 N 1925;—VIII. **52**: 447–460. *f. 1–2.* 18 D 1925.

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Wilson, P. with **Britton, N. L.** Botany of Porto Rico and the Virgin Islands. Descriptive Flora. Spermatophyta (continued). N. Y. Acad. Sci. Survey. **6**: 1–158. 14 Ja 1925; **6**: 159–316. 31 Au 1925.

PUBLIC LECTURES DURING MAY AND JUNE

Following is the program of the illustrated lectures for May and June. They are given in the Museum Building of The New York Botanical Garden on Saturday afternoons, beginning at 4 o'clock. Doors are opened at 4:15 to admit late comers.

May 1.	"Variation, Heredity, and Environment in relation to Evolution."	Dr. A. F. Blakeslee.
May 8.	"The Bermuda Islands."	Dr. Fred J. Seaver.
May 15.	"Tulips."	Mr. Kenneth R. Boynton.
May 22.	"The Land of Cotton."	Dr. Israel Weinstein.
May 29.	"Iris and its Culture."	Dr. George M. Reed.
June 5.	"Floral and Scenic Features of Porto Rico."	Dr. H. A. Gleason.
June 12.	"The Extinct Flora of New York City and Vicinity."	Dr. Arthur Hollick.
June 19.	"Roses."	Dr. Marshall A. Howe.
June 26.	"Our Friend John Burroughs."	Dr. Clara Barrus.

NOTES, NEWS, AND COMMENT

Dr. Marshall A. Howe, Assistant Director, has been elected a member of the National Research Council.

Professor Robert A. Harper, chairman of the Board of the Scientific Directors of The New York Botanical Garden, has been elected a member of the Council of the National Academy of Sciences.

Dr. John K. Small, Head Curator, left New York on April 17, for a tour of botanical exploration in southern Florida. Letters indicate that points on the Gulf Coast as far west as New Orleans have also been visited.

The following visiting botanists have enrolled in the library during the winter months: Prof. M. L. Fernald, Cambridge, Mass., Miss Violet I. Edlemann, Wellesley Farms, Mass., Prof. L. H. Bailey, Ithaca, N. Y., Professors William I. Bray and L. H. H. Pennington, Syracuse, N. Y., Miss L. K. Herring, Ambler, Pa., Dr. Walter T. Swingle and Prof. R. Kent Beattie, Washington, D. C., Mr. J. N. Couch, Chapel Hill, N. C., Prof. E. N. Transeau, Columbus, Ohio, Mrs. Eileen W. Erlanson and Prof. Bradley Moore Davis, Ann Arbor, Mich., Prof. W. L. Jepson, Berkeley, Cal., Dr. Mel T. Cook, Rio Piedras, Porto Rico, Dr. Henrik Lundegårdh, Lund, Sweden, and Dr. Hans Glück, Heidelberg, Germany.

The Spring Inspection of The New York Botanical Garden, under the auspices of the Board of Managers and the Advisory Council, was held on the afternoon of Thursday, May 6. The best of May weather favored the occasion and more than three hundred people were in attendance. The chief feature in the way of a floral display was the collection of Narcissi in the Horticultural Grounds, where more than 60,000 plants, representing 146 varieties, were at just about the climax of their beauty and diversity. The early tulips, the Rock Garden, the plantations of evergreens, and the flanking of forest trees in young leaf combined with the profusion of daffodils to make a picture of exquisite charm.

A most interesting recent gift to the Garden libarary is a complete set of the *Acta Societatis regiae scientiarum upsaliensis,* presented by Mr. Kenneth K. Mackenzie. The five small quarto volumes (bound at present in two volumes) were for the years 1740 to 1750, and were published from 1744 to 1751. The papers contained in this series cover a wide range of topics, but among them are ten of a botanical nature, one or more in each volume. Of these, six were by Linnaeus, then professor of botany at Uppsala. The one of greatest value to our library, however, is the earliest local flora of what is now the state of New York; the only one, in fact, published in colonial days. It was entitled *Plantae Coldenghamiae in provincia noveboracenses americes sponte crecentes;* was written by Cadwallader Colden (1688–1776), long a prominent figure in the history of New York colony; and described in detail 237 species of plants collected on his great 3,000-acre estate, "Coldengham," in Orange County. The manuscript was sent by Colden to Gronovius, and by him to Linnaeus, who was responsible for its publication. It was issued in two parts, in successive volumes of the Acta; it had been available in our library, one part in a loaned volume, the other in a photostatic copy, but the library now owns for the first time the complete original.

Meteorology for April. The total precipitation for the month was 1.72 inches. The maximum temperatures recorded for each week were 65° on the 10th, 61° on the 16th, *83° on the 22nd,* and 69° on the 30th. The minimum temperatures were 29° on the 6th, *25° on the 12th,* 26.5° on the 20th, and 33° on the 27th.

ACCESSIONS

LIBRARY ACCESSIONS FROM OCTOBER 16 TO DECEMBER 31, 1925

A census of the plants of Victoria with their regional distribution and the vernacular names. Melbourne, 1923. (Given by the National Herbarium of Victoria).

Biological bulletin. Vols. 45 48. Baltimore, 1923–25. (Given by Dr. F. H. Blodgett.)

BRUNNER, J. *Plantes de l'herbier de J. Brunner comprénant principalement la flore des environs de Rosenlaui, Faulhorn, Grimsel & Furca.* (Dried specimens; given by The New York Public Library.)

GRESHOFF, MAURITS, ed. *Rumphius gedenkboek.* Haarlem, 1902.

GROUT, ABEL JOEL. *The moss flora of New York City and vicinity.* New Dorp, 1916. (Given by Dr. J. H. Barnhart.)

HÅRD AV SEGERSTAD, FREDRIK. *Sydsvenska florans växtgeografiska huvudgrupper.* Malmö, 1924. (Given by the University of Uppsala.)

LISTER, ARTHUR. A *monograph of the Mycetozoa Ed. 3 revised by Gulielma Lister.* London, 1925. (Given by the Torrey Botanical Club.)

LINNAEUS, CARL. *De potu chocolatae* Holmiae, 1765.

———. *Flora jamaicensis.* Upsaliae, 1759.

———. *Flora oeconomica.* Upsaliae, 1749.

———. *Flora palaestina.* Upsaliae, 1756.

———. *Fructus esculenti.* Upsaliae, 1763.

———. *Fundamentum fructificationis.* Upsaliae, 1762.

———. *Iter in Chinam* Upsaliae, 1768.

———. *Observationes in materiam medicam.* Upsaliae, 1772.

———. *Opobalsamum declaratum* Upsaliae, 1762.

———. *Planta Alströmeria.* Upsaliae, 1762.

———. *Planta aphyteia.* Upsaliae, 1776.

———. *Plantarum jamaicensium pugillus.* Upsaliae, 1759.

———. *Prolepsis plantarum.* Upsaliae, 1760.

———. *Purgantia indigena.* Upsaliae, 1766.

———. *Specifica canadensium.* Scarae, 1756.

LINNÉ, CARL VON (*filius*). *Nova graminum genera.* Upsaliae, 1779.

Message from the President of the United States, transmitting a report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the southern Appalachian region. Washington, 1902. (Given by Dr. F. H. Blodgett.)

MOORE, CHARLES, ED. *The improvement of the park system of the District of Columbia.* Washington, 1902. (Given by Dr. F. H. Blodgett.)

PASCHER, ADOLF A., ED. *Die Süsswasser Flora Deutschlands, Osterreichs und der Schweiz.* Heft 12: *Cyanophyceae, by L. Geitler.* Jena, 1925.

Phytopathology. Vols. 1–7. Baltimore, 1911–17. (Given by Dr. F. H. Blodgett.)

PRINCE, WILLIAM ROBERT, & PRINCE, WILLIAM. *The pomological manual.* 2 vols. New York, 1831. (Given by Mrs. John W. Paris.)

———. Ed. 2. New York, 1832. (Given by Mrs. John W. Paris.)

REICHENBACH, HEINRICH GOTTLIEB LUDWIG. *Icones florae germanicae et helveticae.* Vol. 10. Lipsiae. (Given by Mr. K. K. Mackenzie.)

RICHARDS, CHARLES RUSS. *The industrial museum.* New York, 1925. (Given by the American Association of Museums.)

STENAR, A. HELGE (SVENSSON). *Embryologische Studien* 1–2. Uppsala, 1925. (Given by the University of Uppsala.)

SVENSSON, HARRY G. *Zur Embryologie der Hydrophyllaceen, Borraginaceen und Heliotropiaceen, mit besonderer Rücksicht auf die Endospermbildung.* Uppsala, 1925 (Given by the University of Uppsala.)

THUNBERG, CARL PETER. *Museum naturalium Academiae upsaliensis.* Pt. 4. Upsaliae, 1787. (Given by Messrs. Björck & Börjesson.)

———. *Auctum.* Pt. 1. Upsaliae, 1827. (Given by Messrs. Björck & Börjesson.)

WILSON, ERNEST HENRY. *America's greatest garden, the Arnold Arboretum.* Boston, 1925.

———. *The lilies of eastern Asia.* London, 1925.

MUSEUMS AND HERBARIUM

239 specimens of flowering plants and ferns from Minnesota. (By exchange with the University of Minnesota.)

100 specimens of flowering plants from Great Britain. (By exchange with the Imperial Forestry Institute, University of Oxford.)

15 specimens of flowering plants from Alberta. (By exchange with Mr. N. B. Sanson.)

3 specimens of flowering plants from Indiana. (By exchange with Mr. Albert A. Hanson.)

620 specimens of flowering plants from Brazil. (By exchange with the Riksmuseum, Stockholm.)

3 specimens of *Carduus nutans* from Maryland. (Given by Mrs. Sarah G. Miller.)

1 specimen of *Radicula sylvestris* from New Hampshire. (Given by Mr. R. S. Barlow.)

4 specimens of flowering plants from the Southern States. (Given by Mr. W. W. Ashe.)

3 photographs of *Zamia* and *Microcycas* from Cuba. (By exchange with Professor M. A. Chrysler.)

50 specimens of flowering plants from Missouri. (Collected by Mr. B. F. Bush.)

250 specimens of flowering plants from Mexico. (Colected by Mr. C. A. Purpus.)

4 specimens of flowering plants (types) from Colorado. (Given by Mr. George E. Osterhout.)

4 specimens of flowering plants from Utah. (Given by Professor A. O. Garrett.)

1 specimen of *Carex purpurifera* from Campbell County, Tennessee. (Given by Mr. John Bright.)

20 specimens of flowering plants from Cuba. (Given by Dr. Juan T. Roig.)

4 specimens of ferns from the West Indies. (By exchange with the United States National Museum.)

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17 specimens of flowering plants from tropical America. (By exchange with the United States National Museum.)

100 specimens of flowering plants from Europe. (By exchange with Professor Hugo Glück, Heidelberg, Germany.)

10 specimens of flowering plants from Alberta. (Given by Mr. R. H. Dixon.)

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50 specimens of flowering plants from the Rocky Mountains. (By exchange with Professor M. A. Chrysler.)

4 specimens of fungi from Georgia. (By exchange with Professor H. M Miller.)

1 specimen of *Midotis verruculosa.* (By exchange with Dr. James R. Weir.)

1 specimen of *Ciboria nebulosa.* (By exchange with Dr. Edwin E. Honey.)

1 specimen of *Dasyscypha Agassizii.* (By exchange with Dr. Edwin E. Honey.)

1 specimen of *Hypomyces lactifluorum.* (By exchange with Mr. Oliver P. Medsger.)

3 specimens of fungi from Iowa. (By exchange with Professor G. W. Martin.)

3 specimens of fungi from Porto Rico. (Given by Mr. C. M. Tucker.)

21 specimens of flowering plants from North America. (By exchange with the United States National Museum.)

120 specimens of flowering plants from the collections of the "St. George" Expedition. (By exchange with the Royal Botanic Gardens, Kew, England.)

17 specimens of flowering plants from North America. (By exchange with the United States National Museum.)

1 specimen of *Serapis Helleborine* from Pennsylvania. (Given by Mr. Harold W. Pretz.)

15 specimens of Mimosaceae. (By exchange with the United States National Museum.)

103 specimens of flowering plants from Yunnan, China. (By exchange with the United States National Museum.)

500 herbarium specimens from Porto Rico. (Collected by Dr. and Mrs. N. L. Britton.)

10 specimens of flowering plants from Porto Rico. (Given by Professor H. T. Cowles.)

7 specimens of flowering plants from Mona Island. (Collected by Mr. H. E. Anthony)

250 herbarium specimens from St. Croix. (Collected by Mr. J B. Thompson.)

8 specimens of flowering plants from Porto Rico. (Given by Professor E. E. Dale.)

2 specimens of flowering plants from St. Thomas. (Given by Mr. Arthur S. Fairchild.)

200 specimens of tertiary fossil plants from Porto Rico. (Collected by Dr. Arthur Hollick, Dr. N. L. Britton, and Mr. W. D. Noble.)

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Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the twelfth volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

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THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

VOL. XXVII JUNE, 1926 No. 318

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

CYCADS

JOHN K. SMALL

FURTHER NOTES ON THE FLOWERS AND SEEDS OF SWEET POTATOES

A. B. STOUT

A PORTRAIT OF MRS. DALY

N. L. BRITTON

CONFERENCE NOTES FOR MARCH

PUBLIC LECTURES DURING JULY AND AUGUST

NOTES, NEWS, AND COMMENT

ACCESSIONS

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JOURNAL
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The New York Botanical Garden

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CYCADS[1]

"Cycads"—the "Sago-palms" of popular parlance—is a name used to designate a small group of plants quite definitely isolated and sharply differentiated from all other groups of existing plants; "Sago-palms," because their pithy stems yield a starch somewhat similar to the sago, which is obtained from the stems of several kinds of true palms, which, however, belong to quite a different part of the plant kingdom.

Cycads appeared during the Triassic period of Mesozoic time. They replaced the cycad-ferns which flourished in Paleozoic time, and represented a step higher in the vegetable scale. Their development and increase continued up to the Cretaceous period, when their climax in abundance and almost universal distribution was reached.

The geologic record, as at present interpreted, indicates nearly three hundred fossil species of this group, which are classed in about thirty-five genera. These remains are preserved as stems, leaves, flowers, and fruits. They are found wherever geologic explorations have been made—from the equator to the poles. The evidently generally salubrious climate of those geologic times was conducive to a vast growth of this newly developed, so to speak, type of vegetation. In fact, these plants became so dominant that the term "Age of Cycads" has been applied to the Mesozoic Age. One is inclined to consider the assemblage of fossil remains referred to above a mere fraction of the cycad flora of those remote ages, for without doubt, the majority of the forms were denied a

[1] Abstract of a lecture and demonstration given in Conservatory Range 2 of The New York Botanical Garden on Saturday afternoon, January 23, 1926.

permanent record as fossils in the earth's strata. The following schedule will show the position of cycads in geologic time.

Neozoic	Quaternary	CYCADS reduced to about 80 species
	Tertiary	Higher flowering plants abound
Mesozoic	Cretaceous	CYCADS DECLINE
	Jurassic	Higher flowering plants appear AGE OF CYCADS
	Triassic	
Paleozoic	Carboniferous	CYCAD-FERNS, Ancestors of Cycads abound
	Devonian	Ferns and fern allies appear Land plants appear
	Silurian	Seaweeds develop
	Cambrian	Seaweeds appear
Proterozoic	Proterozoic	No evidence of plant life
Eozoic	Eozoic	No definite evidence of life

A cycad plant consists of a stem, either subterranean or aërial, which bears a crown of branching feather-like leaves, in all resembling a tree fern in habit. Ultimately, clusters of flowers and seeds grow from the axils of the leaves. The stem is very pithy and typically simple, but in the case of subterranean ones it is frequently branched. The leaf is pinnately compound, that is, it

consists of a stalk (midrib) with the leaflets distichously arranged on either side, except that of *Bowenia,* which is bipinnate.

The leaflets show three types of venation. In the first type the secondary veins run from the midvein to the margin of the leaflet, after the manner of most of our ferns and of the cycad-ferns from which our present day cycads may have been derived. This is illustrated by the leaves of the genus *Stangeria* only. In the second type no definite midvein is present, but several simple or branched "parallel" veins run from the base of the leaflet to the apex,—illustrated by the leaves of the genera *Zamia* and *Dioön.* In the third type the leaflet has a strong midvein, which may represent the several veins of type number two, collected into one bundle. There are no lateral veinlets. The tissue between the midvein and the margin is uniform and thallus-like. This we find illustrated by the leaves of the genus *Cycas.*

The inflorescence and the fructification of cycads are interesting. The staminate and pistillate organs consist of leaves more or less modified so that they hold the pollen-sacs and the ovules, and ultimately the ripened seeds. The staminate organ is the more uniformly modified. The leaflets have become changed into more or less peltate scales spirally arranged about the leaf-axis, thus forming a cone-like structure. The pollen-sacs are borne in groups on parts of these scales, except on the exposed surface. The pollen is exceptional—as with Ginkgo—among flowering plants in that it develops motile sperm-cells after germination. The ovulate organ is less constant in its cone-like character than is the staminate. In some of the genera it is a cone of imbricated peltate scales which bear the ovules and the seeds on the inside of the apical expansion. In other genera the ovules and seeds are borne on the edges of the midrib of the less modified leaf, either in the axils of reduced leaflets or in place of the leaflets. The seeds are nut-like or berry-like, and sometimes highly colored.

The Age of Cycads has long been past. During the Cretaceous period, which followed the periods (Triassic and Jurassic) of their maximum development, this type of vegetation not only lost ground in point of numbers of kinds, but also in the breadth of geographic range. They were forced to begin a retreat from the polar regions. Unfavorable climatic conditions and changes in

the earth's surface hastened and finally brought about their extermination in the higher latitudes of both northern and southern hemispheres. For example, in the northern hemisphere in the Tertiary period the cycads had retreated southward as far as southern Europe, where they were represented, as far as the evidence goes, by a single species of *Encephalartos,* and southern North America, where the representatives were species of *Zamia* and *Dioön.*

To complete the devastation, the rigors of the great Ice Age at the beginning of the Quaternary period pushed this ancient group still further south, even to near the latitude of the Tropic of Cancer. The range of the genus *Encephalartos* shrank into the confines of Africa, and *Zamia* retired to the Florida peninsula, while *Dioön* retreated across the Rio Grande into Mexico. How much ground, if any, these cycads regained, since the retreat of the ice we do not know. Apparently they did not return far into their former domains, although enough vigor remains in their blood to withstand a colder climate than exists within their present ranges, as is indicated by their being successfully cultivated in the open northward of the natural northern limit of the geographic ranges, the maximum distance depending upon local climatic conditions.

From a world-wide geographic range and the maximum number of genera and species cited above, the total existing cycad population and its geographic distribution may be summarized as follows:

About sixteen species of *Cycas,* in eastern Asia to Australia and Indo-Pacific.
About fifteen species of *Macrozamia* in Australia.
A single species of *Bowenia* in Australia.
About fifteen species of *Encephalartos* in Africa.
A single species of *Stangeria* in Africa.
About thirty species of *Zamia,* in tropic and subtropic America.
About eight species of *Ceratozamia* in Mexico.
About three species of *Dioön* in Mexico.
A single species of *Microcycas,* in Cuba.

In other words the geologic strata have given up nearly four times as many fossil genera and species as are represented in the

FIGURE 1. In Royal Palm Hammock, Dade County, Florida. Several colonies of *Zamia silvicola* occur on the hammock floor in the dense shade. The leaves and leaflets are spreading. The ancestors may have been carried there by flood water, by animals, or by the Florida aborigines who made this island a rendezvous, if not a permanent settlement site.

living flora. This number, although large, is very likely only a fraction of the geologic maximum. This is evidence that the cycads are a vanishing type of vegetation.

Curiously enough, the present-day cycads simulate the modern palms in their geographic distribution. Their distribution in geologic times also coincided, for the palms were once universally distributed over the land surface of the earth. In North America the limiting latitude of the cycads lacks only about five degrees of that of the palms. In the eastern hemisphere about the same discrepancy exists in the Europe-Africa region; while in the East the ranges of the two groups extend northward into southern Japan and southward into Australia.

The early travelers in the East and in the West were not slow to observe the cycads, and to bring them back to their native lands. Botanical descriptions and illustrations of them began to appear in the sixteenth and seventeenth centuries. Thus, their botanical history began shortly after distant travel was undertaken by Europeans. The modern botanical nomenclature began with the formal publication of the genus *Cycas* by Linnaeus in 1753. Ten years later he established the genus *Zamia.* Thus in the eighteenth century the types of the largest genera of cycads were fixed, the one in the eastern hemisphere, the other in the western, and the regions of both diametrically opposite. More than a half century elapsed before additional cycad groups were proposed. As a result of explorations in more remote regions, new cycads were brought to light, and were added to botanical literature in chronological sequence as follows: *Encephalartos,* 1834 (Africa); *Macrozamia,* 1841 (Australia); *Dioön,* 1843 (Mexico); *Ceratozamia,* 1846 (Australia); *Stangeria,* 1853 (Africa); *Bowenia,* 1863 (Australia); *Microcycas,* 1868 (Cuba).

Cycads are closely associated with the history of mankind. They have and do appeal to him physically, aesthetically, and spiritually. In this way they also very closely parallel the palms.

The stems of cycads furnish a flour or starch which has been used by man from prehistoric times. In countries where the growth is abundant it forms a staple food, where imported it usually constitutes a luxury. It is also used to starch fabrics.

Taking examples from our own country, we know, according to the records of Hernando de Escalante Fontanada, a captive in

FIGURE 2. On Robert's Island in the Everglades west of Little River, Dade County, Florida.—Here the *Zamia silvicola* grew in partial shade. The leaves and leaflets are rigid and largely erect. The ancestors may have been taken there by the Florida aborigines, who used the island as a place of residence, as is evidenced by the many-stemmed live-oaks.

Florida for seventeen years in the sixteenth century, that the Florida aborigines—an isolated group of the American Indian, now extinct—"made bread of roots [*Zamia*], which is their common food the greater part of the year." Commenting on this statement it has been recorded that "The flour, prepared from the root, is called by the Spaniards Kun-ti hat-ki, 'white bread,' to distinguish it from the red bread, from the China briar-root, which they call Kun-ti tscha-ti." Referring to the use of this cycad by the Seminole Indians, Dr. William Baldwin recorded that "I had the gratification to find the 'Wild Sago'," or Coontia,[2] of the Seminoles. . . . At supper, I had the pleasure to eat the bread prepared from the large tuberous root [stem] of this plant. In the late time of difficulty many negroes, and others, were prevented from perishing from hunger by having recourse to it; . . .[3]

Although the odds are evidently against the cycad and it is without doubt a vanishing type of plant, the natural growth in Florida, which furnished flour to the aborigines and to the Seminoles, and in a transition period—the seventies of the last century—to the Cubans for starching their linen,[4] now furnishes the white man with "Arrowroot crackers," for many of our arrowroot crackers are made, at least in part, from "Florida arrowroot," which is one of the names for the flour made from the native cycads of Florida.[5] Cycads play a large part in horticulture.

[2] Bow-legs, the grandson of Bartram's "Long Warrior," says, that "Coontia" signifies Bread Plant.

[3] For a history of *Zamia* in Florida see, "Seminole Bread——The Conti." —Journal of The New York Botanical Garden **22**: 121–137. 1921.

[4] The manufacture, and export, of Coontie-starch was the main occupation and source of revenue of the pioneers of southern peninsular Florida.

[5] There are four species of *Zamia* in Florida: one of them is also native in Cuba; the other three are, apparently, endemic in Florida. The following is described here for the first time.

Zamia silvicola Small, sp. nov. Leaves 1 m. long or less; leaflets 12–17 cm. long, the blades linear, often broadly so, 1–1.5 cm. wide, 14–20-veined, flat, obscurely toothed at the apex: staminate cone cylindric or slightly tapering upward, 8–16 cm. long: mature ovulate cone ellipsoid-cylindric, mostly 9–14 cm. long: nut-like part of seed broadly obovoid, 18–20 mm. long, decidedly flattened, minutely pointed at both ends. Humus, rich sandy soil, aboriginal village sites, and shell mounds, peninsular Florida.—The most robust Zamia in Florida, often abundant on the upper west-

They are easily grown and are very decorative objects. In warm regions species of *Cycas* and *Zamia* are used in out-of-door plantings. In conservatories in the cooler latitudes all the genera may often be found in a thriving condition and perfectly adapted, apparently, to their artificial habitats. In this way, again the cycads parallel the palms; and likewise, both primitive people and some of our contemporaries in their spiritual cravings consider the cycad a symbol, both of Life and of Death.

JOHN K. SMALL.

FURTHER NOTES ON THE FLOWERS AND SEEDS OF SWEET POTATOES

As ordinarily grown, sweet potatoes are most decidedly sterile in respect to the production of capsules and seeds. The two main conditions responsible for this unfruitfulness are (1) the habit of non-blooming, especially throughout the more northern areas of their culture, and (2) the failure, even when blooming profusely, to set seed either to self-pollination or to pollination between plants of the same clonal variety. It should be noted that the various plants of the variety are all propagated from branches of one original seedling and that hence pollination between plants of the variety is the same as pollination between flowers on a single plant.

In a number of instances, however, seeds of sweet potatoes have been obtained and the breeding for new varieties from seed has been possible. The summary of these cases and the data bearing on the blooming and seeding habits of sweet potatoes were assembled from published records and from a rather extensive correspondence and published in considerable detail.[1] Since this report appeared further data have come to hand and also fruit and seeds have been obtained in controlled pollinations

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ern coast, and locally in hammocks southward in the peninsula. Plants on the shell mounds often have branching stems. This hammock inhabitant differs from the pineland-inhabiting species —*Zamia integrifolia*—in the more numerously veined, wider, and more remote leaflets, and the flattened nut-like part of the seed.

[1] The Flowers and Seed of Sweet Potatoes. Journal of The New York Botanical Garden **25**: 153–168. June, 1924

of seedling sweet potatoes grown at The New York Botanical Garden.

The blossoming of sweet potatoes in New Jersey

During the past season (summer of 1925) in the New Jersey areas of sweet potato culture there was rather heavy blooming of certain varieties, a condition rarely seen or possibly never seen before in this region. The writer is indebted to Professor R. F. Poole, of the New Jersey State Experiment Station, for the following record.

"I observed very closely the blooming of the White Yam variety of sweet potatoes this past summer, since flowers were produced on this variety in several fields. The blooming was frequently very great, since in some instances single vines produced as many as twenty-five flowers. As early as the first of August, many flowers were observed on the White Yam and Golden Gem, a strain of the Porto Rican variety, which were grown side by side in the same field, and on the Porto Rican and Triumph varieties in other fields, but in no case were seed produced. I have never seen flowers on the Jersey varieties. However, some of the oldest growers say that they have seen them bloom once or twice in the many years that they have been growing this crop. No attempt was made to cross-pollinate the varieties that did bloom, although flowers were present on the two varieties at the same time. The blooming was most profuse on plants that were stunted. On areas where the pox disease, caused by *Cytospora Batatas*, had injured the roots severely, and on extremely acid or extremely alkaline soils there was heavy blooming. On adjacent areas, where the vine growth was normal to heavy, there were very few flowers produced on these same varieties."

Previous to this season it appears that flowers have only occasionally been produced by sweet potatoes grown in New Jersey. The data on the blooming habits of this group of plants (published in the paper already cited) show clearly that many if not all varieties bloom freely in the tropics. In the more northern belt of their culture sweet potatoes thrive vegetatively and yield good crops of roots under environmental conditions that do not favor the formation of flowers. Evidently in 1925 certain conditions which favor blooming were in some way realized in New Jersey. No fruits and seeds were apparently obtained but no cross-pollinations between varieties were attempted and evidently different varieties were not interplanted sufficiently to facilitate natural cross-pollination.

Seed of sweet potatoes in Queensland

In the earlier account published in this Journal and already cited, a quotation was given from an unpublished report by C. B. Brooks to the effect that in Queensland, Australia, "the sweet potato apparently is not fertile to its own pollen and that to produce seed it is necessary to cross-pollinate by hand." Since this was published a report has come to hand bearing the date 1923[2] which contains the following interesting statement.

"The seed was secured from those growing in the propagating bed. Approximately six crops of vine cuttings were removed during the summer, and it was in the subsequent growth that was allowed to stand over the winter that blooms appeared. It was found that although several sorts flowered very freely, no seed was produced. It was thought that in all probability the flowers might not be fertile to their own pollen, so recourse was made to cross-fertilization. This produced fertile seed."

Seed of sweet potatoes in the Virgin Islands

The breeding of sweet potatoes from seed has been continued at the Agricultural Experiment Station, St. Croix, Virgin Islands, and concerning the results there obtained the Director of the Station, Professor J. B. Thompson, has written as follows:

"You will be interested to hear that we have done a little work this year with the sweet potato, involving controlled pollination. I have just now finished collecting the last seed to mature and am sending you a summary of the results. You will note that we used a relatively large number of combinations. This comes from the fact that we regarded this year's work largely in the nature of the preliminary operations and we had only small experimental plantings to work upon and they did not flower in quantities to suffice for doing all the work we wanted to do on the varieties we preferred.

"Your results seem to bear out the theory of self-incompatibility and our limited work on this line seems to corroborate your views. Last February (1925) we made 196 attempts to effect self-pollinations and got only one fruit containing a single seed. This one fruit was obtained from a seedling variety of which 24 flowers had been selfed. In all, 21 varieties were included in the 196 self pollinations. We also made 22 crosses between seedling No. 263 and *Ipomoea Nil* (L.) Roth, 20 between this same variety and *Quamoclit coccinea* (L.) Moench, but got no results in either case."

[2] The Sweet Potato, C. B. Brooks, Department of Agriculture and Stock, Queensland.

"There is some reason for the failure of sweet potato fruits to set during a part of the flowering period. We frequently see flowers as early as October and there is an abundance of them through December and January but seed seldom set before February. The sweet potato is flowering freely at this time but so far I have failed to observe any fruits starting to set. I have not attempted any controlled pollination work excepting that of last February.

"With the exceptions of the numbers 311 and 314 all seedlings were developed from seed of the three varieties Bigwig, Blackrock, and Key West Yam, when grown in adjacent plantings, and it is thought that these varieties crossed freely among themselves. Numbers 311 and 314 are Wrenchy seedlings and are thought to have resulted from natural self-pollinations as the seeds were produced on a planting that was isolated from other varieties. As close breeding might have a bearing upon sterility, the female parent of the different seedlings used in this work is given in all cases in which this is available."

In a most recent letter from Professor Thompson it is stated that the blooming season of 1925–1926 has thus far been unfavorable to the flowering of sweet potatoes and that for a large number of varieties the anthers have been imperfectly formed and the pollen apparently worthless.

It is of interest to note that the summary of the pollinations made at St. Croix shows that 23 different cross-combinations were tested, involving four named varieties and various seedlings. In one cross (Blackrock x Key West Yam) 76 flowers were pollinated but only two yielded capsules. The highest percentage of successes was had from crossing a seedling with the variety Bigwig; of the fifteen flowers cross-pollinated 8 capsules and 13 seeds were obtained. Several combinations failed completely and in one as many as 62 flowers were involved. In most cases rather few flowers set seed but a total of 54 capsules and 77 seeds were obtained, all from cross-pollination.

Seed obtained at The New York Botanical Garden

During the winter of 1924–1925 the flowering of sweet potato plants in a greenhouse at The New York Botanical Garden made controlled cross-pollinations possible and from some of the combinations capsules and seeds were obtained.

These plants were grown as follows. Cuttings were made in the spring of 1924. The young plants grew rapidly and were

FIGURE 1. Until recently the capsules and seeds of sweet potatoes have rarely been known. The cultivated varieties are propagated vegetatively as clonal varieties and are decidedly self-fruitless. By making cross-pollinations between plants of *certain different* varieties seeds may be had. The seedlings grown from such seed are decidedly self-incompatible.

The capsules shown above were produced at The New York Botanical Garden by cross-pollination between certain plants which were themselves self-fruitless.

soon in six-inch pots which were placed on a bench in a greenhouse where they remained undisturbed throughout the summer and the following autumn and winter. The vines grew well; some to a length of about ten feet. The roots became much crowded, filling the pots and extending down into the ashes of the bench.

Of the 100 plants thus grown only seven bloomed but these belonged to six different pedigreed clons from seedlings grown from seed supplied from Santo Domingo by Dr. B. H. A. Groth.

One plant bloomed from November 22, 1924, until April 16, 1925, producing a total of twenty-five flowers. The lowest number of flowers on a plant was five.

Self-pollinations were made on all the plants and for several as many as ten flowers were selfed. Not a single capsule was set to self-pollination.

Fourteen different cross-combinations[3] were made involving from one to twelve flowers each. Only four cross-relations were successful but from these eight mature capsules were obtained (see FIGURE 1). In the most successful combination two of the five flowers crossed yielded capsules.

CONCLUSION

The results obtained at St. Croix indicate that seed is not, as a rule, there produced by sweet potatoes during the first part of the period of their blooming. This suggests that some type of sterility may be operating at this time. Whether this involves a direct environmental influence on fruit setting, or the imperfect development of flowers for a time, or a cyclic change in the compatibilities of fertilization is not now apparent.

It seems very clear from all the evidence now at hand that during the period of maximum blooming the type of sterility operating in sweet potatoes is that of incompatibility in the processes of fertilization. Most seedlings and most clonal varieties appear to be completely self-incompatible.

Various combinations in cross-pollination likewise fail, but certain compatible relations are to be found which readily yield fruit and seeds. This type of sterility is rather frequent in plants

[3] Most of these were made by Miss Hester M. Rusk, Technical Assistant at The New York Botanical Garden, whose efficient assistance in this and other projects of research deserves special mention.

both wild and cultivated and in varieties that are propagated vegetatively (clonal varieties) it very frequently reduces yield of fruit, as in certain fruit crops, and seeds for use in breeding, as in the sweet potatoes, unless provision is made for the particular cross-pollination necessary for the setting of fruit.

A. B. STOUT

A PORTRAIT OF MRS. DALY

Mr. Frank K. Sturgis, a vice-president of The New York Botanical Garden, has presented to the Garden Library a framed oil painting of the late Maria Lydig Daly (Mrs. Charles Patrick Daly).

It will be recalled by founders and other older members of the Garden that Mrs. Daly was very active in its establishment during the years 1888 to 1894, serving as a member of the committee of the Torrey Botanical Club which obtained the charter of the institution from the State Legislature in 1891, and she was subsequently chairman of a committee of ladies appointed to aid the original corporation in raising $250,000 required by the charter, which was completed in 1895, thus enabling the Commissioners of Public Parks to set aside and appropriate land in Bronx Park for the use of the Garden, and the Board of Estimate and Apportionment subsequently to appropriate money for the erection of buildings.

Mrs. Daly died in August 1894. Judge Daly, her husband, also indefatigable in the creation of the Garden, survived her several years and in addition to taking part in the original subscription and influencing other contributors, made bequests resulting in the David Lydig Fund, and the Charles Patrick Daly and Maria Lydig Daly Fund, both permanent and highly useful endowments.

Mr. Sturgis, who has made this valued gift, is a brother-in-law of Mrs. Daly, having married the late Florence Lydig, a younger sister.

N. L. BRITTON

CONFERENCE NOTES FOR MARCH

The regular monthly Conference of the Scientific Staff and Registered Students of the Garden was held on the afternoon of March 3rd.

Dr. Fred J. Seaver spoke on "Mycology of the Bermuda Islands" outlining his recent trip and calling attention to a few of the interesting fungi collected. A full account of this expedition appears elsewhere in the JOURNAL, under report on "Mycological Work in Bermuda."

Mr. E. J. Schreiner reported on "Studies of fiber length in poplars." This was a report on the variation of fiber length in the wood (secondary xylem) of several species of poplar, with special reference to the variation in fiber length in a single growth ring. Fiber measurements on *P tremuloides* and *P. Eugenei,* indicate clearly that the average fiber length varies from the spring wood (inner part) to the summer wood (outer part) in any annual ring. The average length increases somewhat irregularly from the first formed wood to the summer wood, and then falls very rapidly. The average length in the inner one-third of any ring was always found to be shorter than the average length of the outer one-third of the same ring. Mention was also made of variation in average fiber length in different parts of the tree trunk.

A. B. STOUT,
Secretary of the Conference.

PUBLIC LECTURES DURING JULY AND AUGUST

The following is the program of the lectures for July and August. They are given in the Museum Building of The New York Botanical Garden on Saturday afternoons, beginning at 4 o'clock. Doors are opened at 4:15 to admit late-comers.

July 3. "The Survival and Protection of Harried Flowers." Raymond H. Torrey.

July 10. "Immunization against Diseases caused by Microscopic Plants." Dr. H. H. Rusby.

July 17. "Lilies." Dr. A. B. Stout.

July 24. "The Oil Olive: Tree and Fruit." Miss Ada Sterling.

July 31. "Our Forests and their Uses." Dr. Israel Weinstein.

August 7. "Popular Books on Botany." Dr. J. H. Barnhart.
August 14. "Reef-building and Land-forming Plants." Dr. Marshall A. Howe.
August 21. "Among Sea-bird Cities of the Atlantic." S. Harmsted Chubb.
August 28. "English Gardens." Mr. Montague Free.

NOTES, NEWS, AND COMMENT

Notices have been sent to members of the Garden, indicating that the Darwin tulips were expected to be at their best from May 12 to May 19 and that the collection of named lilacs, including 185 different kinds, represented by about 550 bushes, would be in most profuse bloom from May 20 to May 27. Both collections were visited by many people during the periods named. The climax of the flowering of the Narcissi so nearly coincided with the Annual Spring Inspection on May 6 that no special notices were sent out. Announcement has been made that the Iris collection was expected to be at its best from June 8 to June 16 and that the peony collection would begin to bloom during that period and might continue for a week thereafter.

The newly appointed Chairman of the Rock Garden Committee of the Advisory Council of The New York Botanical Garden, Mrs. Edward C. Bodman, has sent a gift to be used for lantern slides, particularly of rock-loving plants. Several others have contributed slides, Mrs. Wheeler H. Peckman of daffodils and irises, Mrs. Mortimer J. Fox of lilies, Miss Fleda Griffith of cultivated plants, and Mrs. N. L. Britton of native plants, particularly wild flowers. The slide collection is already a notable one and additions are being made, illustrating special features of the Garden and plants grown in it.

Among the visitors to the library during the spring months were the following botanists: Dr. Alfred Rehder, Arnold Arboretum, Jamaica Plain, Mass.; Mr. Ivan M. Johnston, Cambridge, Mass.; Profs. A. W. Evans and G. E. Nichols, New Haven, Conn.; Prof. A. P Saunders, Clinton, N. Y.; Profs. L. H. Bailey and Lester W. Sharp, Ithaca, N. Y.; Dr. A. F.

Blakeslee, Cold Spring Harbor, N. Y.; Prof. Geo. H. Shull and class, Princeton, N. J.; Miss A. Isabel Mulford, Milburn, N. J.; Prof. John W. Harshberger, Philadelphia, Pa.; Mr. Edwin B. Bartram, Bushkill, Pa.; Mr. Eugene A. Rau, Bethlehem, Pa.; Dr. H. L. Shantz, Mr. and Mrs. W. W. Eggleston, Dr. Edgar T. Wherry, and Mr. William R. Maxon, Washington, D. C.; Dr. M. W. Lyon, Jr., South Bend, Ind.; Prof. H. Pittier, Caracas, Venezuela; and Prof. Y. Yoshii, Sendai, Japan.

Meteorology for May. The total precipitation for the month was 1.64 inches. The maximum temperatures recorded for each week were 79° on the 8th, 79° on the 12th, *88° on the 18th* and *82°* on the 30th. The minimum temperatures were *37° on the 5th*, 39° on the 13th, 43.5° on the 21st and 42° on the 24th.

ACCESSIONS

LIBRARY ACCESSIONS FROM APRIL 21 TO OCTOBER 15, 1925

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GIBSON, HENRY H. *American forest trees* Chicago, 1913.

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HAGEN, CARL LEONHARD. *Untersuchungen über die Entwickelung und Anatomie der Mesembryanthemeen* Bonn, 1873.

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ACCESSIONS

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MORPHOLOGY OF POLLEN GRAINS IN RELATION TO PLANT CLASSIFICATION[1]

The wide range of variation in the character of pollen grains in the different plant families has long been a matter of comment. As long ago as 1687 Malpighi is said to have made the statement that pollen grains have different forms in different plants. Geoffroy (1711) stated that the form of the pollen grain is constant for each species. Purkinje (1830) depicted the form of the pollen grain of each group of plants, following the natural classification, as then understood. Von Mohl (1835) built up an elaborate artificial classification of pollen-grain forms.

In his classification von Mohl divided all pollen grains into two classes, viz., those that have one membrane and those that have two membranes. In the former he put only the Milkweeds. The latter class he again divided into those with folds or pores and those without folds or pores. Of the latter he made three groups (1) those with surface papillate, (2) those with surface granular, and (3) those with surface cellular. Following along these lines he constructed a very complete and carefully worked out key with a place for every possible form of pollen grain and several hundred species carefully illustrated and assigned to their places in the key. Unfortunately, however, when one comes to apply the key, it is soon found that the assigning of any particular pollen grain to its group is frequently a matter of opinion. It often fits equally well any one of several groups and, the groups being artificial and based on characters which are often more superficial than fundamental, entirely unrelated species are

[1] Abstract of a preliminary report presented before the monthly Conference of the Scientific Staff and Registered Students of The New York Botanical Garden on December 2, 1925.

brought together and species of the same genus often put asunder. Thus in the first subdivision (no folds or pores, surface granular) we find *Calla, Crocus, Sagittaria, Ranunculus,* etc., plants all unrelated and certainly the absence of pores in *Sagittaria* is an opinion that can not universally be accepted (FIG. 1). Moreover, the different species of *Sagittaria* would be widely separated on this basis, for some are definitely spiculated while others are merely granular.

One can not fail to be lost in admiration of the enormous task that von Mohl undertook and the painstaking way in which he set about its accomplishment and it is likely that, had he had at his disposal modern microscopic equipment, he would have accomplished a complete and accurate classification of pollen-grain forms.

This method has been revived from time to time even to the present day (Pope, 1925) but always with much less success than that achieved by von Mohl. Von Mohl examined his pollen grains both moist and dry, clearly stating the effect of moistening. Thus he says "Many grains have folds running from pole to pole. When the grain is made wet it expands and the part which was inside the fold becomes the outside but the portion which was hidden inside the fold always shows a structure different from the rest of the membrane although it may be in immediate contact with it."[2] Subsequent investigators have not noticed this fact and have failed to take account of von Mohl's work. Some have insisted that the pollen grains must be observed in the dry or "natural" condition and have discredited the work of others who have mounted the grains in water for observation (Smith, 1876). Others have taken the opposite point of view with the result that pictures of the same species by different authors often bear no resemblance to each other.

What is the natural condition of pollen? This is a question that has seemed of the greatest importance to some investigators. Pope (1925) maintains that it is the dry and shrunken condition as seen in freshly shed pollen but Stephen and Harlan (1920), speaking of barley pollen, say that normal grains are spherical but that they rapidly lose water and shrink. Martin and Yocum (1918) state that apple pollen, when shed, is nearly spherical but

[2] Free translation.

shrinks rapidly owing to drying and assumes the form of a double convex lens. On the other hand, in most species of the Compositae the pollen when shed is already in the shrunken condition.

It is quite apparent that both conditions are equally natural but—in view of the facts that many species have a well-defined folding mechanism adapted to the accommodation of the grain to changes in volume arising from changes in moisture content and that, as pointed out by von Mohl, the part hidden in the fold is always different from the rest of the surface, and, further, that the germinal apertures are often hidden in the bottoms of these folds,—in view of these facts it becomes apparent that pollen grains will reveal more characters in the fully expanded condition than they will in the dried and collapsed condition. The latter is only interesting to us in that it adds one more feature, viz., the mode of shrinking. Accordingly, pollen grains should be examined both moist and dry, but the detailed studies should always be made on moist and fully expanded grains.

The Grass Family affords a good example of the effect of drying. Examined dry, the pollen grains have been variously described as angular, prismatic, truncated-pyramidal and in no instance does the author of any of these descriptions show a germinal aperture. In this condition no characters are apparent that can be considered of phylogenetic value, nor anything to distinguish grass pollen-grains from many other entirely unrelated species. On the other hand, if we examine the different species of grass in the moist condition, we find that as pointed out by the author (Anon., 1925); they are all practically the same, always smooth and spherical, ovoid or ellipsoid. The most important feature, however, is the germinal aperture; scarcely visible in the dry condition, it is now seen to be a small pit in the top of a slight elevation, partly closed by a small operculum which is a hemispherical thickening in a very delicate membrane stretched across its opening (FIGS. 2, 3, 4). About one hundred species of grass have been examined and this character is found to hold for all. The differences that are observed are in the size and, in those that are not spherical, in the relative position of the germinal aperture. Otherwise the similarity in character throughout the family is quite remarkable.

Thus we see that a study of the pollen grains of the Gramineae in the moist condition alone reveals their one and only funda-

mental character, viz., a single germinal aperture in a slight elevation, closed by an operculum and, since this character is not found elsewhere, it stamps the grains that possess it as belonging to the Grass Family.

Owing to the extreme simplicity of the grass pollen-grain they exhibit no other characters that can be used at all adequately to distinguish the different species, genera or even tribes from each other. A slight aid is offered in this direction, in the size. A large range of different sizes is found in this family. Thus the pollen grain of *Poa annua* is 27 μ in diameter, while that of *Zea Mays* is 87 μ. Notwithstanding this fact, however, most of the grass pollen-grains are so similar in size that but little help can be secured from this source. The shape offers some little help in specific and generic identification. Thus *Avena* is ovoid with the germinal aperture at the large end. *Secale* is ellipsoid with the germinal aperture on the side but by far the majority are spherical and still others exhibit all three forms.

The number of characters of any pollen grain is, at the best, very small. These characters may be classified as follows (1) Character and arrangement of germinal apertures; (2) Adornments and texture of the exine; (3) Number and arrangement of folds (sometimes this is best observed in the dry form); (4) Shape, *i.e.*, spherical, ellipsoid, etc.; (5) Size.

In studying the relation of morphology of pollen grains to classification, it is necessary to select first the fundamental characteristics and, since these are not always the most obvious characters, this can be done only by studying related species, related genera, and sometimes related families. Thus among the Sagittarias, we find that in *S. montevidensis* (FIG. 1), the exine is provided with short, nearly cylindrical spines, the grain is nearly spherical and is about 25.3 μ in diameter and has about ten large germinal apertures, which are peculiar in being surrounded by a fringe of the exine. The most obvious character is probably the presence of spines but an examination of some of the other species of the genus shows that this is not really a fundamental character for in some the spines are reduced to mere granules. The one character which holds for all species, as in the Gramineae, is the form of the germinal apertures. They vary in size and apparently they vary in number but they are always

round and surrounded by a ragged fringe of the exine. Now, if we examine *Alisma,* a neighboring genus, we find that the grain is spherical, slightly smaller, nearly smooth, the spines being represented by rather indistinct granules, but the germinal apertures are round and surrounded by a fringe of the exine. They differ, however, in being smaller and more numerous. We are now in a position to say that the most fundamental character is the form of the germinal aperture. The spines or granules of the exine and the number of the germinal apertures are only secondary characters. This enables us to predict, with a reasonable amount of certainty, that all plants as closely related to *Sagittaria montevidensis* as is *Alisma* will be found to have its peculiarly shaped germinal apertures but the surface of their exines may be expected to be more or less spiny, granular, or even nearly smooth.

In many pollen grains the apparent characters are so few that it is difficult to select and designate any as fundamental. This is particularly true of the thin-walled grains as, for example, *Phoenix dactylifera* (FIG. 5) and *Carex stricta* (FIG. 6). These are both smooth and without conspicuous markings on the exine. *Carex* is broadly ovoid while *Phoenix* is ellipsoid. Neither has a well-defined germinal aperture but each has a weak spot through which the pollen tube may emerge. The chief difference between the two is that, in *Phoenix,* the weak spot is along the side, while in *Carex* it is on the large end. If, however, we examine the grains in the dry condition, we find that *Phoenix* collapses by a single deep furrow running the entire length of the grain, causing it to resemble a dried wheat seed (FIG. 7) and it can be seen that the thin part, through which rupture takes place, is within the fold. *Carex,* on the other hand, collapses without any special fold (FIG. 8), the walls just caving in, causing the grain to resemble a truncated pyramid with the sides slightly concave, exactly as in the Gramineae, and leaving the point of rupture exposed. These differences seem to point to constitutional differences of much more fundamental importance than any that are apparent on the surface.

The heavy-walled pollen grains generally present a larger number of apparent characters than can be found in the thin-walled grains. For example, in the Chenopodiaceae, the grains have a well-defined exine with round apertures cut sharply into it. These

openings do not reach all the way through. There is always a thin membrane across the bottom which possesses the same staining characteristics as the exine itself. Of the other characters, perhaps the most important is the texture of the exine, which varies all the way from practically smooth to roughly and coarsely reticulate. Nevertheless, an examination of the genera of this family and the neighboring families, Amaranthaceae and Nyctaginaceae, reveals the fact that all have holes cut sharply into the exine. It is true that these holes vary enormously in number. In *Sarcobatus vermiculatus* (FIG. 9), which is one of those possessing the fewest, there are fourteen or sixteen. From this number the different species exhibit different numbers up to about one hundred. The variation, however, is haphazard and does not follow any phylogenetic arrangement. It even varies slightly for different individuals of the same species. In fact the number of germinal apertures can not even be used to distinguish the families from each other. The presence, however, of this particular type of germinal aperture is a character definitely correlated with their phylogenetic relationships.

Another family with thick-walled grains of well-defined character is that of the Compositae. Species of this family are generally described as spiculated. Truly this is the most conspicuous character but one does not have to seek far to see that it is not the most fundamental. It is true that the spiculated form is prevalent in the Compositae, even in the Cichoriaceae and to a certain extent in the Ambrosiaceae. There are, however, exceptions found scattered throughout the family. For example, the grains of *Artemisia* are quite smooth (*e.g., Artemisia tridentata,* FIG. 10) and yet other species so closely related to *Artemisia* that they are regarded as belonging to the same tribe (Anthemideae) are just as spiny as any of the Compositae, for example, *Anthemis Cotula* (FIG. 12). Obviously then the spiny character is not fundamental. A more important character is found in the peculiar texture of the surface. This character, though comparatively inconspicuous, is found to persist throughout the Anthemideae as far as these studies have been carried and we have attempted to indicate it in the figure or *Artemisia tridentata* (FIG. 10) and also that of *Anthemis Cotula* (FIG. 12). This character must, therefore, be regarded as more fundamental than the very much more conspicuous character of the spines which

are present in most of the Anthemideae other than the Artemisias.

There are, however, characters which are persistent throughout the entire family and to which we have found no exceptions. These are the heavy-walled exine with three germinal apertures, each set in the base of a longitudinal fold. It is true that these characters are found elsewhere outside of the Compositae but the fact that they obtain throughout the entire family designates them as fundamental to it.

The Cichoriaceae have the three germinal apertures characteristic of the Compositae. They are further complicated by a very elaborate and beautiful pattern which frequently gives them a somewhat angular appearance, which leads to their being spoken of by most investigators as polyhedral or dodecahedral, appellations which are entirely inadequate though useful (FIG. 13). This pattern, though varying in details, particularly in the massiveness of the elevated part, is found to hold throughout the family as far as these investigations have been carried. Decaisne (1834) states that *Catananche caerulea* and *Scolymus grandiflorus* are not polyhedral, describing them as spherical and echinate.

Our own observations, however, fail to substantiate this view although we would likewise hesitate to call either species polyhedral. *Scolymus grandiflorus,* at any rate, resembles very closely *Nabalus altissimus* shown in FIG. 10 and *Catananche caerulea,* though bearing less resemblance, is not entirely dissimilar to it. This peculiar pattern can therefore be regarded as characteristic of the Cichoriaceae as distinguished from the rest of the Compositae.

From these observations it becomes apparent that characters of a pollen grain are profoundly and intimately associated with its phylogenetic relationships. When pollen grains are dry and collapsed few of the important characters are apparent but when moistened and expanded the hidden characters are exposed to view. If a study is made of the shape and arrangement of the germinal apertures, the adornments and texture of the exine, the number and arrangement of the folds, and the shape and size of the grain and from these characters the fundamental sifted out from the superficial by comparison with known relatives, valuable information regarding phylogenetic relationships can be obtained.

R. P. WODEHOUSE

Explanation of figures 1–13

The following figures show pollen grains illustrating the resemblance that related species bear to each other in their fundamental characters while sometimes differing widely in certain other characters which may be more conspicuous. They also show that the more important characters are often displayed to better advantage when the grains are moist and expanded than when dry and collapsed.

Fig. 1. Pollen grain of *Sagittaria montevidensis* C. & S., showing the ragged germinal apertures. 25.3 μ in diameter.

Fig. 2. Pollen grain of *Secale cereale* L., showing the single germinal aperture characteristic of the Gramineae. 57.5 μ in diameter.

Fig. 3. Germinal aperture of *Secale cereale*, as seen in optical section. Shows the operculum suspended across the mouth of the opening.

Fig. 4. Pollen grain of *Phleum pratense* L., showing similarity to *S. cereale*. 37.5 μ in diameter.

Fig. 5. Pollen grain of *Phoenix dactylifera* L., in the moist and fully expanded condition. Compare with Fig. 7.

Fig. 6. Pollen grain of *Carex stricta* Lam., in the moist and fully expanded condition. Compare with Fig. 8.

Fig. 7. Pollen grain of *Phoenix dactylifera* L., in the dry and collapsed condition, showing the single fold. Compare with Fig. 5.

Fig 8. Pollen grain of *Carex stricta* Lam., in the dry and collapsed condition, showing mode of contraction without definite folds. Compare with Fig. 6.

Fig. 9. Pollen grains of *Sarcobatus vermiculatus* Torr., showing the smooth germinal apertures characteristic of the Chenopodiaceae and allied families. 25.3 μ in diameter.

Fig. 10. Pollen grain of *Artemisia tridentata* Nutt., expanded and showing a germinal aperture in its fold, characteristic of the Compositae. 25 μ in diameter.

Fig. 11 Optical cross section of pollen grain of *Artemisia tridentata*, showing the three germinal apertures in their three longitudinal folds which are here fully expanded.

Fig. 12. Pollen grain of *Anthemis Cotula* L., showing a germinal aperture in its fold, here expanded, also surface texture characteristic of the Anthemideae and the spines which are frequently found in the Compositae. 25.3 μ in diameter.

Fig. 13. Pollen grain of *Nabalus altissimus* (L.) Hook., showing pattern characteristic of the Cichoriaceae.

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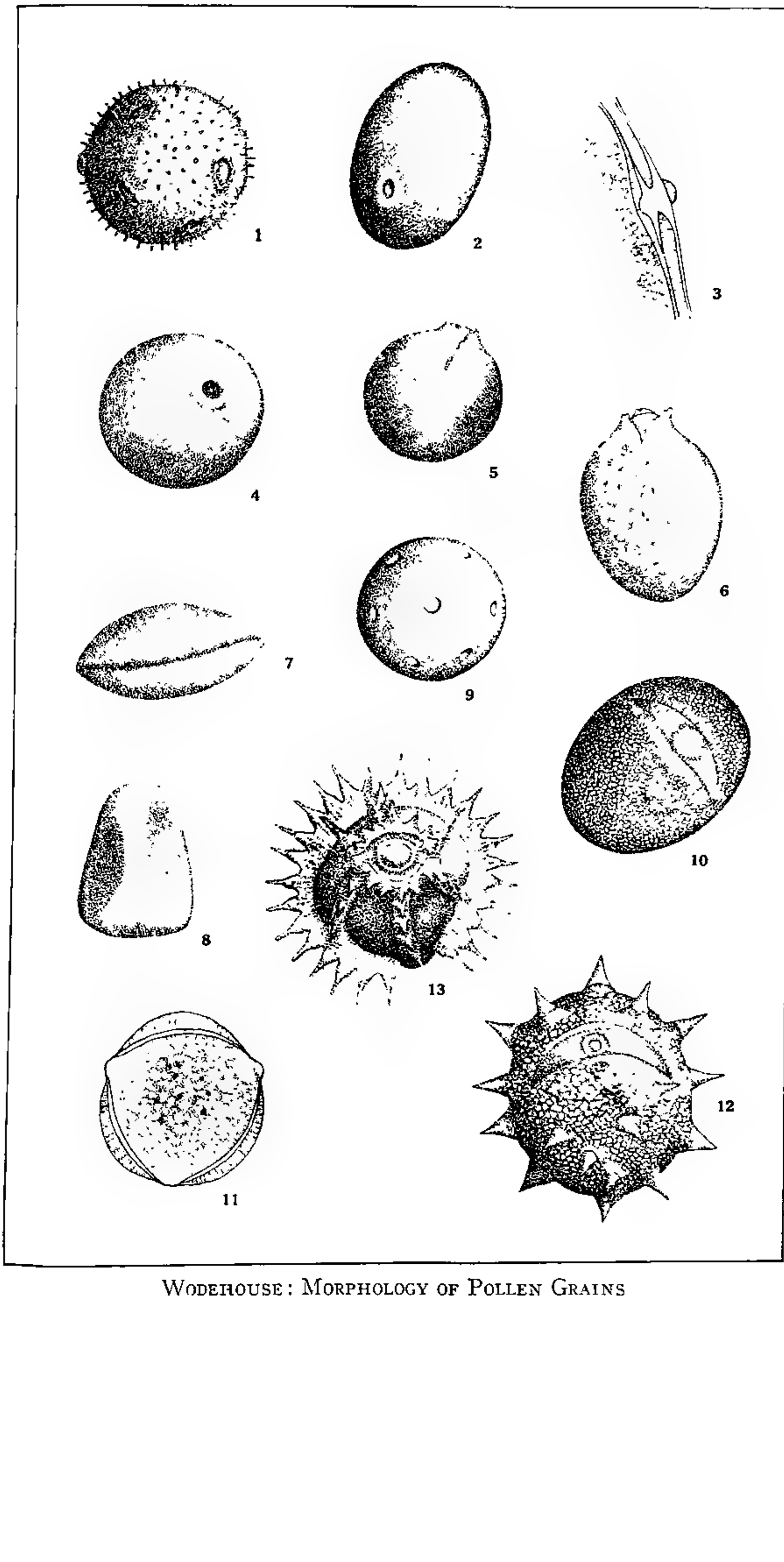
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WHY ARE CHESTNUTS SELF-FRUITLESS?

It has frequently been observed that chestnut trees which stand alone do not yield satisfactory crops of nuts.

Dr. Wm. A. Taylor, Chief of the Bureau of Plant Industry, writing in the Standard Cyclopedia of Horticulture (Vol. 2, p. 745) summarizes this condition for the American group of chestnuts as follows:

> "Solitary trees are frequently sterile, although producing both staminate and pistillate flowers, apparently requiring cross-pollination to insure fruitfulness. This is especially true of planted trees of this species on the Pacific slope, where productive trees are reported to be rare."

It is quite probable that this statement applies equally well to the varieties of chestnuts of the European and Japanese groups to which many of the cultivated varieties belong.

During the autumn of 1922 the writer had an opportunity to observe the condition of sterility in two chestnut trees of undetermined variety growing apart from each other and isolated from other chestnuts at Claremont, California. These trees were heavily loaded with burs but those of one tree contained only shriveled nuts without "meats" or embryos and in the several bushels of burs from the other tree there were only about thirty nuts which contained meats. The empty nuts were much shrunken with the sides pressed together. The trees bloom profusely and they bear many fruits but the burs rarely contain a good seed.

It was not possible for the writer to make proper tests to determine if the seedless fruits on these trees develop entirely without any pollination and if they will yield good nuts to cross-pollination but perhaps the latter may be assumed.

The cultivated varieties of chestnuts are clonal varieties. Each originated in a single seedling that was propagated vegetatively. They differ rather widely in respect to the number of seeds that are normally produced in a bur, the number ranging from one to as many as seven or eight. They differ also in other phases of productivity. Being merely branches of one original seedling, the different plants of a variety are very uniform in such characteristics as flower behavior and the requirements for fruit and seed production.

But all varieties are able to bear good fruit. No nurseryman, horticulturist, or breeder ever propagates a seedling of any fruit or nut crop and develops a clonal variety from it unless it has borne fruit satisfactorily. But the first judgment of the fruiting ability of a seedling and usually also of the first plants propagated from it is nearly always based on performance in mixed plantings where there is opportunity for cross-pollination. The ability of the variety to bear fruit is thus demonstrated but there is no clue to its requirements for pollination. If the variety requires to be cross-pollinated before it will yield satisfactory crops, this need first becomes evident when a tree is grown in isolation or when trees of the variety are grown in solid blocks.

Pollination seems to be a prerequisite for seed-setting by most chestnuts. But this does not apply to all chestnuts, for Dr. Robert T. Morris reports[1] that plants of the American Chinquapin may freely mature fruits with viable seeds without any pollination whatever. This ability to produce seeds apogamously may also appear in other chestnuts and especially in some of the hybrids which have the chinquapin for a parent.

But apparently most varieties of chestnuts require cross-pollination before they will yield adequate crops of nuts containing meats. It is not yet fully clear why this is the case. To determine this one must first give attention to the flowers as to their ability to function, their behavior in development and the requirements for pollination and fertilization.

The flowers of chestnuts are described as monoecious. It should not, however, be taken for granted that the two kinds of flowers are fully functional. A variety may produce fruit and seeds and yet be more or less sterile as a male. The staminate

[1] Chestnut Blight Resistance. Journ. Heredity **5**: 26–29, 1914.

flowers may yield impotent pollen. This may readily be determined by appropriate germination tests and by microscopic examination. But most varieties probably do produce good or viable pollen.

There is much evidence that the flower behavior of chestnuts has an intimate relation to proper pollination and is perhaps responsible for the self-fruitlessness so frequently observed. The best statement regarding the flowers and their development which the writer has seen is that of G. Harold Powell, published in the Eleventh Annual Report of the Delaware Agricultural Experiment Station for the year 1899. The statements there made regarding the flowers of chestnuts may be quoted in full.

FIGURE 1. *Below.* The several bushels of chestnut burs here shown fell from a large tree standing at one side and with its branches above the driveway in which the burs were piled. The large crop of burs seemed to promise a harvest of nuts.

Above Rarely did a bur yield a nut containing a meat. The total harvest was a small handful of good nuts.

Evidently many varieties of chestnuts are self-fruitless. Cross-pollination seems to be necessary for adequate yields of good nuts.

> "The Blossoms. The chestnut is monoecious, that is, the male and female flowers are separate on the same tree. Young, vigorous-growing trees frequently produce male flowers only, and after their excessive vegetative vigor ceases and the trees become older, the female flowers develop. The staminate flowers are borne in long, slender catkins, and are much more numerous than the pistillate flowers. The pistillate flowers are clustered at the base of a long catkin, on the distal end of which the staminate flowers open later in the season, the catkin aborting down to the little female blossoms.
>
> "The pistillate flowers are probably fertilized by both sets of staminate blossoms, the early ones fertilizing the early opening blossoms, and the later ones furnishing the pollen for those that are retarded. Thomas Meehan tells me that he thinks the pollen from the late staminate blossoms performs the function of fertilization, and that the great show of staminate catkins is a waste of energy, in the American chestnut. In both European and Japanese varieties, I have noticed that most of the pistils are receptive while the early staminate flowers are in bloom."

From this description for chestnuts in general, it appears that certain catkins bear only staminate flowers which mature rather early. Other catkins bear both pistillate and staminate flowers

FIGURE 1. Nearly complete sterility in chestnuts.

which mature later. There is evidently some question as to what extent, if any, the relative development of the two sexes admits of self-pollination and whether the flowers all yield good pollen. This may differ very decidedly for the various species and clonal varieties in cultivation and for the hybrid seedlings that now exist in considerable number.

But the self-fruitlessness of chestnuts may involve a lack of fertilization. Even when there is ample self-pollination the fertilizations necessary for the development of seeds may not take place. This is a type of sterility very common in plants, which limits yields of fruit in clonal varieties unless there is proper cross-pollination. Cross-pollination between certain varieties may also be incompatible and still further limit fruit-setting, as is the case for certain sweet cherries.

The statements regarding "self sterility" of chestnuts do not indicate or specify the degrees or grades of sterility present. In an extreme or complete sterility, fruits do not even start to develop. The developments of seedless fruits, as seen for the two trees mentioned above, may be only one grade of the sterilities seen among chestnuts.

It is evident that cross-pollination is needed to insure adequate yields of nuts by many varieties of chestnuts. This can only be provided for by interplanting varieties whose blooming habits coordinate sufficiently to insure proper pollination. If this is not accomplished the interplanting of two varieties may not increase fruitfulness. It will probably take some study, considerable experimentation, and the results of practical experience in orchard plantings to determine the varieties which pair to give most profitable results for both.

It is indeed highly desirable that each variety of chestnuts be carefully studied regarding (1) the ability of the various flowers to function, (2) the relative maturity of the two kinds of flowers and of the early and late staminate flowers, and (3) the requirements for pollination and fertilization necessary for good yields of nuts. This should give some clue as to what varieties will be most satisfactory for interplanting. Then the commercial culture of chestnuts can proceed with greater certainty of adequate yields and of financial success.

A. B. STOUT

THE PERFUME OF NARCISSI (DAFFODILS)

As a number of people object to narcissi because of their strong perfume it seemed worth while, with this point in view, to make an effort to class a portion of the better-known varieties of these flowers. After a short study, it was found that the narcissi fall easily into nine groups, one with no odor and the others with either a pleasant perfume, disagreeable odor, or marked in some definite way. The term "jonquil" has been used because the perfume of this name is distinct and well known, being made from jonquils, which are narcissi. It will be noticed that there are many varieties with no perfume at all and that the majority of others have only slight or very slight perfume. The variety, *Narcissus Tazetta,* "Paper White," that probably has caused the discussion, is not in the list as it is not hardy in the vicinity of New York but it could be classed as very strong jonquil-scented and has a heavier perfume than any of of the others. It seems a pity that because of a failing of one member of a family the rest should be blamed for faults they do not have!

With Perfume

Very slight	*Slight*	*Medium*
Aequus	Aestiva	Cassandra
Emperor	Bard of Avon	Orange Buffer
Epicure	Beauty	
Holbein	Bernardino	
Mrs. Langtry	Brilliancy	
Primrose Phoenix	Great Warley	
Thelma	Kingdom	
	Laurens Koster	
	Maid of Athens	
	Oriflamme	
	Red Beacon	
	Sir Watkin	
	White Queen	
	White Star	

Clean Smell

Very slight	*Slight*	*Medium*
Alice Knights	Augusta	Albatross
Queen of the North	Conspicuus	
Sirdar	Crystal Queen	
	Edison	
	Expectation	
	Lady Arnott	
	Undine	
	Undine	
	Undine	
	Undine	

Sweet Tea

Very slight	*Slight*	*Medium*	*Strong*
Van Waveren's Giant	Autocrat	Bedouin Mrs. Chester J. Hunt	Gloria Mundi Masterpiece Sea Gull

Jonquil

Very slight	*Slight*	*Medium*	*Strong*
Apricot Jaune à Merveille Orangeman Ornatus maximus Salmonetta	Almira Bath's Flame Epic Homespun Mignon Nannie Nunn Plenipo Robert Sydenham Sparkler William Goldring	Admiration Cheerfulness Evangeline Glitter Golden Sceptre Joconde Whitewell	Aspasia Dorothy E. Weymss Haemon Sunset The Pearl

Castile Soap

Very slight	*Slight*	*Medium*	*Strong*
Alfred Glory of Sassenheim St. Olaf Tresserve	Cleopatra Henry Ford M.M. de Graaff Mme. de Graaff Moonlight Snow White Sulphur Beauty White Lady White Queen	Cornelia Czarina Firetail Loveliness Peter Barr	Cossack F. E. McIlvaine Her Grace Lady Audrey S B. Steel Weardale Perfection

Musk

Very slight	*Slight*
Lucifer	Lemon Drop

Sweet Soap

Slight

King Alfred

Disagreeable

Slight

Inglescombe Double
Von Sion

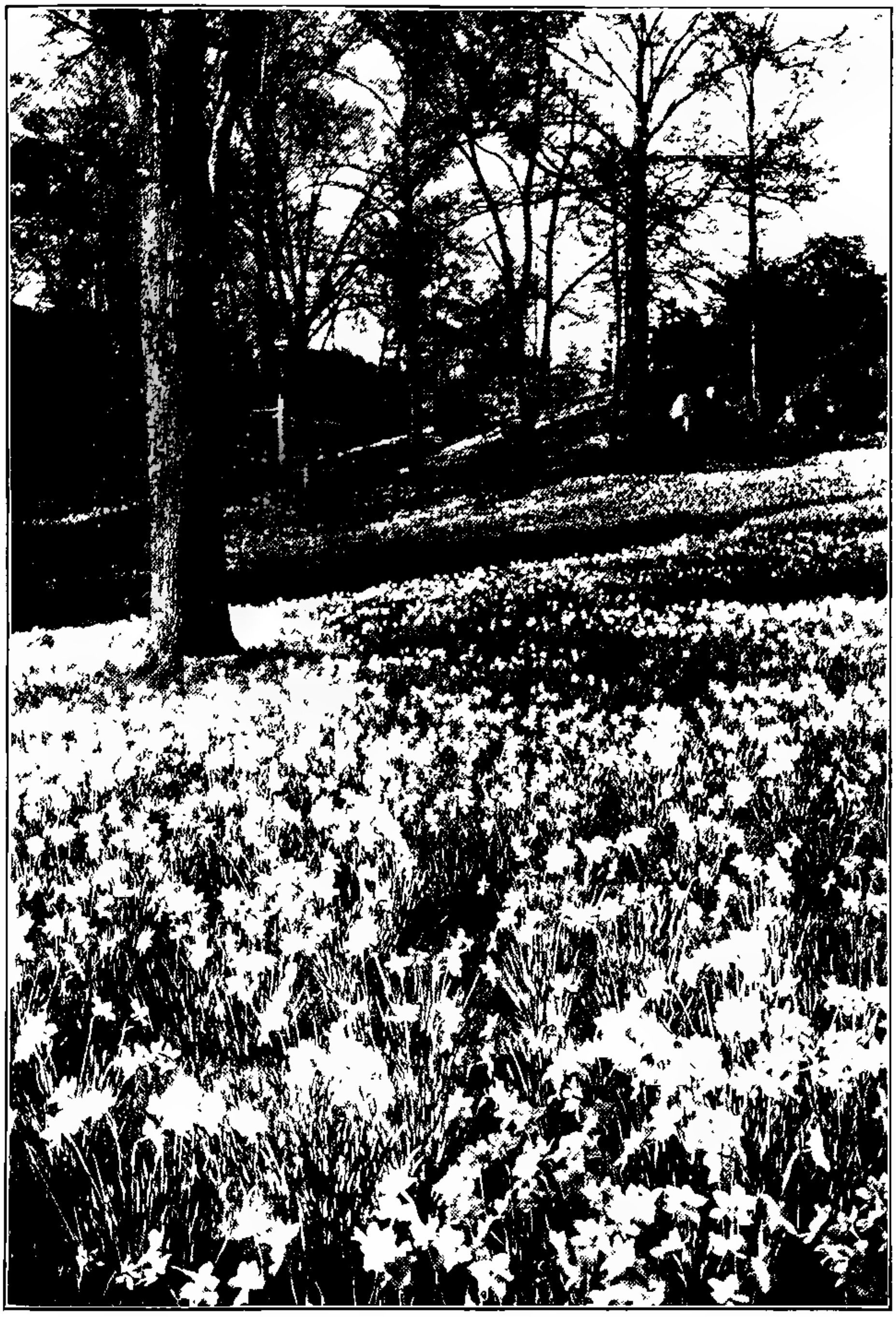

FIGURE 1. A part of the Narcissus plantings at The New York Botanical Garden, May 9, 1926.

No Perfume

Argent	Giraffe	Orange Phoenix
Artemis	Glory of Lisse	Red Chief
Blood Orange	Horace	Rosella
Branston	Ideal (Incomp.)	Southern Gem
Bullfinch	Jacoba	Spring Glory
Candlestick	J. B. M. Camm	Stella
Castile	John Farquahar	St. Vincent
Circlet	Juliet	White Pearl (Leedsii)
Croesus	Lulworth Beauty	Will Scarlett
Edrin	Nobility	W. P. Milner
Emerson	Marina	
Fairy Queen	Miss Ellen Terry	
Firebrand	Mrs. E. Krelage	
Frank Miles	Mrs. Frylink	
	Mrs. Robert Sydenham	

Ethel Anson S. Peckham.

VARIATION, HEREDITY, AND ENVIRONMENT IN RELATION TO EVOLUTION[1]

Variations in plants and animals (including man) are due to two main causes—Heredity and Environment. Both are necessary for life. Though heredity determines the potentialities with which the individual begins life, the environment determines to what extent these potentialities find expression. Examples of the influence of these two factors in bringing about variations were given from both plants and animals. It was shown that the effects of environment seen in corn plants dwarfed by crowding are mostly transient while the effects of heredity seen in dwarf varieties of corn may be lasting. There is no evidence that efforts toward the biological improvement of corn or of man can be effective if the environment alone is considered. No method is known, for example, by which education of the parents can affect the mental capacity of their offspring, since it is capacity alone which is inherited.

Biological Evolution is distinguished from Social Evolution, the first referring to biologic changes transmitted through hered-

[1] Abstract of a lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, May 1, 1926.

ity, the latter referring to changes in environment passed on from one age to the next. The achievements in science, art, and philosophy of our present civilization attest the progress in social evolution within historic time. There is no evidence of a parallel progress during this period in biologic evolution. It is questionable if humanity has any higher mental capacity to-day than in the early days of history.

The lecture was extensively illustrated by lantern slides, chiefly from the speaker's own investigations.

ALBERT F. BLAKESLEE.

THE DESERT VEGETATION OF THE SOUTHWEST[1]

The speaker said that in recent years the concept of what constituted deserts had been extended. There were arctic, or frigid deserts, sand-beach deserts, sand-dune deserts, where the sand drifted, deserts at the bottom of the sea, partial deserts, and true deserts. The true deserts covered parts of the earth's surface where the rainfall was low, or sporadic in occurrence, and where the evaporation during the critical periods of the year exceeded the rainfall, and where the drainage of the water was either rapid through the soil, or by surface run-off. The deserts of the southwestern United States impress one as being green deserts, as one looks across them, as contrasted with the barren, gray deserts of the continents of Africa, Asia, and Australia. There are no deserts in Europe. The growth forms of plants of the true deserts are mainly stem and leaf succulents, spring shrubs, and trees, trees that are leafless during the rainless periods, perennial herbs with bulbs, tubers, and underground stems (that lie dormant until stimulated into growth activity by a spell of rainy weather), and finally annual herbs that produce a seed crop on which the future of the species depends. The cacti are mostly stem succulents, which store water against drought. Recent physiological work has shown that dryness of environment transforms the polysaccharids (certain sugars) into pentosans (mucilage), which, with an affinity for water, explains the storage capacity of the cells, and the cell-wall materials (anhydrides) are also derived from

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, April 17, 1926.

the polysaccharids by a somewhat different chemical transformation. The leaf succulents are illustrated by the species of *Agave*. The speaker went into other details about the structure of desert plants. He emphasized the fact that the desert Indians of the Southwest, the Hopis, the Navahoes, and the Zunis, had learned to utilize the desert plants and they had developed a peculiar agriculture in which they were the first to discover the principles of dry-land farming. The possibility of cultivating maize, beans, pumpkins, cotton, peaches, watermelons, and other plants depended upon their knowledge of the conditions under which those plants thrived. They had developed a civilization based on their intimate acquaintance with desert conditions.

JOHN W. HARSHBERGER.

THE PLANTING OF FLOWER SEEDS[1]

In the planting of flower seeds, one must consider first what kind of soil is to be used; this is usually garden loam, sand, decayed manure, or leaf-mould, if it can be had. The usual mixture is 3 of loam, 2 of manure or leaf-mould, 1 of sand, and sometimes a little lime may be added. The soil must be light so as to allow the tender seedlings to come through. If seeds are covered too deep, the soil is too heavy for them to push through when they germinate. Then they damp off. Other times, there are a few that come up around the edges of the pot, and sometimes you lose them all. Fine seed should be covered very lightly and the larger should be covered about their diameter in depth. Seeds like those of Begonias and other fine seeds can be sown on top of the soil, the soil for these seeds being leaf-mould and sand. The soil must be light, about 2 of leaf-mould and 1 of sand. If saucers can be had, put pan in saucer, cover top with glass, and fill saucer with water. If these very small seeds are watered from the top of the pan, they often get washed out.

Cobaea scandens (Cup-and-Saucer Vine or Cathedral Bells) has peculiar seeds that must be placed edgewise and merely cov-

[1] Abstract of a lecture and demonstration given in the Central Display Greenhouse of Conservatory Range 2 on Saturday afternoon, February 27, 1926

ered with light soil. To get early results, start the seed indoors in March or early April; they can also be sown out of doors in May. After the seeds germinate, it is best to transplant to flats or pans. The seedlings must be transplanted before they get too large. In transplanting these seedlings, it is a good plan to put them about two inches apart, so as to give them enough room till they are ready for the garden. It is a good plan to get small paper pots and transplant these seedlings in them. When taken out of the pots they don't get disturbed. These pots can be put in a flat close together and covered even to the top with soil. When transplanting seedlings from flats or frames, they should be shaded for a few days; if not, they may dry up.

These are some seeds that can be sown in house or directly in the garden: Ageratum, Alyssum, candytuft, Celosia, larkspur, Helichrysum, Gaillardia, balsam, marigold, Calendula, Petunia, snapdragon, Portulaca, and flowering tobacco. Some of the seeds that can be sown in frames are Lobelia, Kochia, Zinnia, Aster, Cosmos, and Begonia.

Samples of seed, materials, and implements used in planting, and methods of soil preparation, sowing, and transplanting, were exhibited and demonstrated by the lecturer.

GEORGE FRIEDHOF.

NOTES, NEWS, AND COMMENT

Dr. A. B. Stout, Director of the Laboratories, was at the State Experiment Station at Geneva, New York, for a time during the blooming of apples and again when the grapes were in flower, for studies of the pollination requirements of fruit crops and in continuing the breeding of grapes to develop hardy seedless varieties.

The Garden has sent out cards stating that the collection of roses was expected to be at the height of its flowering in the period between June 24 and July 1. Due, in all probability, to the sustained cool weather and absence of heavy storms, the peonies and roses, as well as narcissi, tulips, and irises, have experienced an unusually favorable season for the perfection of their flowers.

The American Rose Society made its "President's Annual Pilgrimage" for 1926 take the form of a visit to the rose collection of The New York Botanical Garden on Thursday afternoon, June 24. Mr. F. L. Atkins, President of the Rose Society, conducted the party of about sixty around the Rose Garden, and talked of the more salient varieties. Afterwards the visitors were the guests of Dr. N. L. Britton, Director-in-Chief, at the Boat House Restaurant.

Dr. Joseph Burtt Davy has presented to the Garden Library a copy of the first part of his recently published "Manual of the Flowering Plants and Ferns of the Transvaal, with Swaziland, South Africa."[1] In form it is an annotated enumeration of the native and naturalized plants of these regions, with keys for family, generic, and specific determination, the citation of specimens studied, and descriptions of those new to science. The area covered is about 117,000 square miles, which, for comparison, is about 4,000 square miles less than the area of Great Britain and Ireland, and within it five distinct botanical provinces are recognized. The author resided in South Africa for many years, and thus became acquainted with many of the species of living plants. His field studies and collections were then supplemented by about five years' work at the herbarium of the Royal Botanic Gardens, at Kew, England, where he had access to vast collections of South African plants previously made by other botanists, and to the library; here we had the pleasure of intimate association with him and with Mrs. Burtt Davy while studying there in the summer of 1920. His wife has been of very great assistance during the whole period of this noteworthy investigation.—N. L. B.

Meteorology for June. The maximum temperatures for each week were 85° on the 2d and the 11th, 87½° on the 15th, 87° on the 25th, and *90° on the 30th.* The minimum temperatures were *44° on the 4th*, 51° on the 12th, *44° on the 17th*, and 55° on the 24th. The total rainfall for the month was 2.54 inches.

[1] Small 8vo, pp. 1–272, with 40 illustrations in the text. Longmans, Green & Co., 1926.

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TROPICAL AMERICAN PLANTS AT HOME—V. THE CLIMBING BIGNONIADS

The family Bignoniaceae is chiefly notable for the graceful habit of its climbing vines and the loveliness of its abundant flowers, neither of which characters is suggested in its somewhat cumbersome and unmusical name.

The only representative of the family that is generally known to residents of our northern clime is the Catalpa, or bean tree, and this does not represent the climbers, that are discussed in this article. Almost everyone knows this popular shade tree, of satiny lustrous foliage, but too few stop to examine the exquisite color markings of its flowers. The trumpet-like form of the latter and the long pods with winged seeds, are characteristic of the family in general. The one climbing member of the family that is often seen here, our trumpet-vine (*Bignonia radicans*), has little of the grace and beauty of many other climbing members of the family. This vine, so commonly seen climbing over walls and fences in our southern states, is often cultivated in the north. Its compound leaves are rather graceful and its crimson flowers, in large clusters, are very showy, but they are vivid and glaring, and the plant, as a whole, is rather stiff and coarse. There is one genus in tropical America, *Pyrostegia,* of similar habit and appearance, although the mouth of the corolla is bilabiate. As to most of the remaining genera of our tropics, one must conceive of a similar habit but with longer and more graceful branches, drooping or pendent from greater heights. Rarely do their flowers show either the contracted cylindrical form or the gaudy color of our trumpet-creeper. Their form is more or less campanulate, at least

toward the mouth, and their curves more full and flowing. Their colors are lighter and more delicate, frequently variegated, but not with the abrupt markings of Catalpa. The colors more often blend gradually with each other, as in our petunias and morning-glories, of which these flowers much remind us. The trunks of these vines are for the most part stout and woody, and they climb wide and high, after the manner of our wild grapes. They double and twist into an inextricable and often impenetrable tangle of branches. Flowering within the shade is unusual, but wherever a branch reaches the light, it puts forth its flowering shoots in such numbers that the entire surface of the forest border becomes a mass of bloom. A vine may cover a single tree, or a cluster of them, that will be so buried in flowers as to be conspicuous from a distance; or it may be that the wall of foliage on the shore of a stream will be almost completely covered by long and graceful festoons of flowers. In such locations, it is not unusual to find two or more species or genera struggling for position, so that a variety of forms and colors are intermingled. It is difficult to say whether such an effect is more pleasing than an unbroken surface of a single color. Either spectacle, when one can sit and feast upon it, is fully satisfying. So glorious have been my experiences with some of these plants that the recollections continue almost as enjoyable as were the realities. I remember with special pleasure a clump of small trees and shrubs outside of Girardot, in central Colombia, completely covered by a single vine of *Macfadyena*. The color was a delicate lilac or lilac-lavender, unmodified by so much as a variation in shade. The flower-clusters were decompound and of immense size, and were crowded against and amidst one another. This tree had been left standing in the middle of the road, and the shrubbery about it had gradually encroached upon the roadway, until only a narrow track remained on either side. The bower was thus visible from all directions. The effect was distinctly different when viewed upon the shaded and the sunny side, and each, by itself, appeared more pleasing than the other. I recall, also, a large tree standing at the end of a rocky point that extended into the Bopi River, in central Bolivia, so completely enveloped in its canopy of creamy-white flowers of a species of *Lundia* that scarcely a leaf was to be seen. In this case, the flowers were delightfully fragrant, a thing not so common in this as in some families of climbers. Farther down

the same river, we saw trees similarly covered with magenta and with lemon-yellow inflorescence.

Although these plants are widely distributed and abundant throughout most of tropical America, I think their special habitat may be regarded as being along the shores of the lower Orinoco and its tributaries, in Venezuela. In no other region that I have visited do they form so conspicuous a feature of the landscape, the banks of the streams being profusely draped with them for long distances. There, also, we find more variety of color than elsewhere, both as to the mingling of species and the coloration of the individual flowers. These flowers are usually very large and of an open form. Some that I have seen there were several inches in length and as large as an ordinary morning-glory. These shores present a magnificent spectacle on an early morning in May, especially after a nocturnal shower, with the colors reflected in the morning sun. I have spoken of softness as characterizing these colors, an effect that is probably due in part to a fine downiness that usually clothes them, too fine to be itself appreciated, but lending a distinct tone to the coloration. Some of these colors are as soft and lovely as those of our hothouse "Gloxinias" (*Sinningia*).

I have often tried to imagine how a long conservatory would look, devoted wholly to these vines, trained to the rafters, and artistically arranged as to color-effects. So far as I know, such a display would be altogether unique, and as magnificent as unusual. These plants are very strong and vigorous and could be easily grown. The classification and determination of bignoniads, from herbarium specimens, is a matter of great difficulty, and beset with many doubts. Every large herbarium contains numbers of undetermined specimens. The determining characteristics, as to genera, are found chiefly in the pods, rather than in the flowers, or at least in connection with them, and specimens do not often possess both flowers and fruits, these usually not occurring contemporaneously. Another difficulty is that, perhaps in a majority of cases, two or more species are found inextricably intertwined, so that the fruits and flowers collected under a single number often represent different plants. The fruits themselves are of great interest, because of their peculiar forms and surfaces. Often they are long, narrow and bean-shaped, at other times oblong, ellipsoidal or rotund. They frequently have a keel or rib

traversing the middle of the flattened sides. At other times, each of the four edges will bear a thickened ridge, which is sometimes extended into a distinct wing, entire or crenated. In some genera the surfaces are beset with transverse or diagonal rows of warts, while in others, the entire surface is thickly beset with soft spines or slender warts.

The seeds are no less interesting, especially when their movements through the air are observed. Indeed, I have often thought as I have watched them blowing or falling, what a highly abstruse study it would be to correlate their movements with their forms. They are, in nearly all cases, strongly flattened and broadly winged, the wing usually thin and transparent. Sometimes it extends entirely around the seed, in others it is found only at the ends. These ends may terminate in an entire margin with a regular curve, or the curve may be oblique or variously toothed or fringed. It is obvious that such differences, accompanied by a different relative position of the seed body, must cause totally different motions as they pass through the air. I have seen them falling from the top of a tree, assuming a spiral course in a still air, the circle regularly enlarging as they approached the ground. At other times they will take on a jerking or jumping movement, the ends reversing themselves each time. When blown by the wind, they may assume an oscillatory movement. Growing, as they frequently do, at high altitudes, where strong winds prevail, it is not difficult to account for their wide distribution.

Among the different genera, I have found the following of exceptional beauty or interest.

Arrabidaea is one of the largest of our genera. Although its flowers are among the smaller ones, they are produced in great abundance and the vines are very showy, the color being usually purple. They are disposed to assume the salver form. The anther cells lie side by side, or nearly so. Their pods are mostly long, narrow and flattened, and their surface is smooth.

Lundia is similar, but its flowers are mostly larger and variously colored in the different species, being white, rosy or of various shades of yellow. The anther cells are attached at the summit and stand divaricately, as is the case in most of the genera. In this genus they are more or less bearded with stiff hairs.

Macfadyena is one of the most showy members of the family, all things considered. Its flowers are very large, with broad

mouths and throats and of showy colors, such as magenta and violet, and are loosely and gracefully disposed. Its flowers are distinguished by having the calyx split down one side. The species are very numerous and are widely distributed in tropical America, adding greatly to the floral display of the middle and lower Andes. *Cuspidaria* is similar and equally handsome and is distinguished by its elongated pod, which has four corky wings along its edges. *Adenocalymna* is somewhat similar as to its showy flowers, which depend in graceful racemes from the axils of the leaves. It has broad, oblong pods, crossed obliquely by rows of warts.

One of the most graceful and elegant groups, comprising slender vines, pertain to the genus *Anemopaegma,* of which there are many species, especially characteristic of the Andean region. They are usually characterized by beautiful circular leaflets, symmetrically placed at the bases of the petioles, and resembling stipules. The flowers are mostly yellow and usually borne in loose clusters in the axils of the leaves. Their slender flowering stems are usually much elongated and readily adapted to being formed into wreaths. The pods of this genus are usually ovate or oblong and smooth. The flowers of *Pithecoctenium* are sharply and peculiarly curved, with large open mouth, white or violet and exceedingly abundant. The pods are oblong and densely covered with soft spines or slender warts. *Amphilophium* has somewhat similar flowers, though far less showy, and with pods smooth or nearly so. *Callichalmys* is so named in allusion to its beautiful calyx, which is very large, inflated-bellshaped and beautifully colored, its flowers being mostly of a golden yellow.

The fact that we are unable to present any but botanical names for these plants lends emphasis to the fact that they are so little known as never to have received non-professional attention. Not being adapted to culture in the open air outside of the tropics, they are also not adapted to conservatory culture except where space is abundant, while to those who visit the tropics they are known only as they occur naturally, and then not by name. A greenhouse of 100 ft. in length with these vines trained at intervals of 5 to 6 ft. would present an appearance of unique impressiveness.

H. H. Rusby.

PLANT ARROW-POISONS: THEIR SOURCES, PREPARATION, AND EFFECTS[1]

Two theories were offered as plausible explanations of the question, "How did plants come to be used for arrow-poisons?"

The snake-bite theory assumes that the natives, upon seeing the terrible effects of a snake bite, which was apparently accomplished by merely piercing the skin with a sharp point and injecting poison, came to smear their sharp arrow tips with poison when hunting or in warfare.

The latex smear theory, which was favored by the lecturer, suggests that natives upon being wounded, would naturally smear the juice or gummy exudate of some plant over the afflicted area to arrest the blood flow and to heal. Some noted that the use of certain plants resulted in immediate poisoning and death. It is not too much to suppose that sooner or later some native would apply the substance to his arrow tip in order to carry the poison into the body of his game or to destroy his enemy.

Whatever the origin may have been, the beginning of the use of arrow poisons is lost in antiquity. Mention of them is made in the Bible (book of Job) and by Homer, Virgil, Pliny, Alexander the Great, and other classical writers. Arrow-poisons are derived only from the flowering plants. The greatest number of species and the most of the deadly ones are found in the "Contortae," a group of plants in which the flower parts are more or less fused together and twisted in the bud. The chief exception is the upas tree (*Antiaris toxicaria*), which is an Indo-Malayan relative of the edible fig. Many plants entirely devoid of any toxic value are utilized because of custom, superstition, and ignorance. The natives have, however, become familiar in most cases with the more toxic species which occur within the range of their respective localities.

No plant arrow-poisons have been employed commonly in North America with the exception of *Anemone* species in the northern and northwestern Alaska. The blow-gun was used in some regions but never with poisoned darts. There are no records which indicate that the Indians of the United States used vege-

[1] Abstract of an illustrated lecture given in the Museum of The New York Botanical Garden on Saturday afternoon, March 13, 1926.

table poisons extensively for the arrows. The Indians of the southwestern Oregon area utilized the stems of three or four plants in preparing arrow-poisons. The Erie Indians are reported to have used poisoned arrows about 1635 but it is not known what plants, if any, were employed.

The southern half of South America is also without the use of arrow-poisons. Because of their toxic and irritant properties, the natives of northern South America have selected for arrow and dart smearing, certain relatives of the moonseed, of the castor bean, and pepper plants for their mixtures. The most effective arrow poison of the western hemisphere is curare, a substance prepared from the stems of eighteen species of South American *Strychnos.* This substance contains two alkaloids, curine and curarine, which paralyze the motor end-plates. The action is very specific and rapid. The injection of a very minute amount of curare will cause paralysis in a frog in thirty to forty seconds. Monkeys, when only slightly wounded by curare-poisoned arrows, die within ten minutes. Jaguars die in about fifteen minutes.

In addition to *Strychnos* species, African tribes have utilized forty-three species of *Strophanthus.* The free parts of the petals of this plant possess long, thread-like prolongations at the tips. The seeds of one of these species, *Strophanthus hispidus,* furnish the commercial drug, strophantin. Curiously, some African *Strychnos* species have edible fruits and others are poisonous. Moreover, the African *Strychnos* arrow-poisons produce a tetanizing effect by acting upon the spinal cord and the medulla oblongata. Whereas, the South American *Strychnos* poisons produce a paralyzing effect on the heart and muscles, African poisons having *Strophanthus* as a source act upon the heart and muscles. Heart block is rapid.

Among other effective arrow poisons of Africa, is the one prepared from the Calabar bean, a botanical relative of our Lima bean. *Strophanthus* and *Acocanthera* belong to the Dogbane Family. Fra Fra arrow poison of the Gold Coast is prepared from *Acocanthera,* sometimes supplemented by snake venom. This poison caused fifteen deaths among forty five slightly wounded soldiers in the French Soudan. Death resulted in fifteen to twenty minutes, although the arrows were removed immediately. Experimental injections of this poison result in the death

of frogs within several hours; in rabbits within ten minutes; and in monkeys within fifteen minutes.

The principal vegetable poisons used on arrows in Asia and Oceanica are prepared from forty-nine species of *Strychnos*, chiefly *Strychnos Tieute; Anemone* species in northeastern Asia, and *Aconitum ferox* in India. The largest flower in the world—*Amorphophallus*—is used in Java as an irritant to increase the efficiency of the arrow poison. Plants related to the orange and the bittersweet are utilized to some extent in the Philippine Islands in the arrow-poisons. The most powerful arrow-poison of the East is called ipoh (a heart poison). Ipoh is prepared in some instances from *Strychnos Tieute* in Borneo but usually from *Antiaris toxicaria* and *A. innoxia* throughout the Malay Archipelago. This plant belongs to the family of the fig and the hop. This Dyak poison is prepared from the latex of the Upas tree. Ipoh arrow-poison has filled the literature with many fantastic tales regarding its unusual effectiveness. It does possess an energetic principle, antiarin, which causes instant death in small birds and mammals. Frogs become tetanized in six to seven minutes after an aqueous injection of 0.002 gm. of ipoh poison when prepared from *Strychnos Tieute* (strychnine).

Rabbits, after a subcutaneous injection of .005 gm. of Dyak poison when prepared from *Antiaris toxicaria* (the glucoside, antiarin) develop clonic spasms, followed by exophthalmos and death within six minutes.

Specimens of the arrow-poison plants were exhibited, including the South American and African *Strychnos* species, the African Calabar bean, the Alaskan relative of our native buttercup, and the most toxic of all arrow-poison plants—the Oriental ipoh plant. *Amorphophallus* was also of special interest. This Javanese plant is an aroid relative of our jack-in-the-pulpit and skunk cabbage. It bears a single flower which is the largest flower in the world, sometimes reaching the height of ten feet. It has a dirty-red color and possesses a strong foetid odor which attracts carrion flies and repels man. *Amorphophallus* roots and seeds are used as an irritant in arrow-poison preparations. Forty-five lantern slides were shown by the lecturer to illustrate his talk. Unique slides of charts and maps were presented to indicate the relationships of these plants to the plant kingdom as a whole and to give the geo-

graphical limitations of these species and to show the preparation of the poisons. The manufacture and use of the blow-gun and darts as developed in Borneo were also shown by lantern slides. The process is one of the finest examples of Bornean handicraft.

RALPH H. CHENEY.

A HISTORICAL REVIEW OF THE STUDY OF FOSSIL PLANTS[1]

The study of fossil plants, or paleobotany as it is commonly designated, is an infant science as compared with botany—the study of living plants. It was only a little more than a century ago that the science of paleobotany may be regarded as having been born. It may be said to have had its birth in the year 1804, when Ernst Friederich, Baron von Schlotheim, issued his epoch-making work entitled "Beschreibung merkwürdiger Kraüter-abdrücke und Pflanzen-Versteinerungen, ein Beitrag zur Flora der Vorwelt," generally cited and referred to as "Schlotheim's Flora der Vorwelt," in which he boldly advanced the, to us, perfectly obvious proposition that fossil plants "may be the remains of an extinct, so-called pre-Adamic creation, the originals of which are now no longer in existence." Such a preface or introduction would be considered, today, as unncessary for even an elementary text-book on fossil botany, but at that time it was a revolutionary scientific pronouncement.

Our present conception of a fossil is vastly different from the ideas that prevailed at various times in the past. A fossil may be defined as any dead organic matter, either animal or vegetable, which has been buried in the earth and preserved there, either in whole or in part, or which has left its traces there in the form of casts or impressions. Hence fossils may be millions of years old and entombed in solid rock thousands of feet below the present surface of the earth, or they may be only a few days old and lying in some incoherent deposit of sand, mud, or humus that represents a portion of the earth's surface soil. Fossils were formed

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden, on Saturday afternoon, April 11, 1926.

during every day of past time when animal and plant life was in existence. They are in process of formation today, and they will continue to be formed in the future, as long as animals and plants live and die, and their remains are preserved through the normal, ceaseless activities of natural agencies.

Ancient ideas in regard to fossil plants, and fossils in general, seem crude, ridiculous, and inconceivable to us, today; but it should be recognized that in the early days of scientific observation and reasoning natural objects and natural phenomena were studied in the light of what it was thought they ought to or must be, in order that they should conform to preconceived concepts of the universe and its origin.

When fossils first began to attract the attention of observers they were not regarded as the remains of former living organisms, but merely as freaks of nature, or as objects of inorganic or mineral origin, similar to crystals and concretions, which had accidentally assumed resemblances to living things. It was also, for a long time, a popular belief that they were formed in some mysterious way through the influence of the stars.

About the year 1500 A. D. Fallopio advanced the theory that fossils were formed by a precess of fermentation in the Earth's crust. He believed that the bones of mastodons were nothing more than mineral concretions, and he even went so far as to discuss the probability that certain vases and other relics of man's handiwork, unearthed near Rome, were natural mineral forms which had assumed the shapes of artifacts. As late as 1677, Doctor Plot, in his Natural History of Oxfordshire [England], attributed the formation of all fossils to, as he described it, "a plastic virtue residing in the earth"; and Lister, a few years later, described certain fossil shells as "bivalve stones."

In the meantime, however, a few more acute observers were not satisfied with these explanations and had begun to suspect that fossils were the actual remains of former living things. Among the earliest of these observers should be mentioned Bernard Palissy, a worker in ceramics, after whom the celebrated Palissy-ware is named. He wrote about 1580, but he was too far in advance of his times, and his views received but little attention. Gradually, however, the organic nature of fossils began to be recognized, without any idea, however, of the significance which this recognition would inevitably imply. It became fashionable

to consider them as the first discarded experiments of the Creator, before the permanent types of life had been decided upon; or that they might have been made by the Creator to test the faith of mankind; or that they were the remains of the animals and plants that had been destroyed in the Noachian deluge described in the Bible. Several works based upon this latter theory were published, one of the best known of which is Johann Jacob Scheuchzer's "Herbarium Diluvianum," issued in 1723. In this "Herbarium of the Flood," minerals, crystals, concretions, bones of fishes, shells, and leaves are depicted, often exaggerated in details and made to appear as the author thought they ought to look in order to conform to his ideas concerning them.

Critical students, however, had begun to announce that most fossils were different from similar living organisms, and that their method of occurrence indicated a succession of different types, which must have existed at widely separated periods in the Earth's history; and then began the bitter controversy over the *age* of fossils and the vast lapse of past time that this implied. In the early centuries of the Christian Era—and even in certain quarters as recently as the present century—a literal interpretation of the Scriptures was thought, by many earnest and well-meaning persons, to be essential for the maintenance of faith in the Christian religion; hence these new ideas were denounced as erroneous and heretical, for the reason that they were thought to contradict the teaching of the Scriptures. In 1750 the great French naturalist Buffon stated his belief in regard to the true nature, origin, and antiquity of fossils in his "Theory of the Earth"; but he was forced by the faculty of the Sorbonne to recant many of his propositions and conclusions. This recantation was published in his next work, and its opening words were "I declare that I had no intention to contradict the text of Scriptures I abandon everything in my book respecting the formation of the Earth, and, generally, all which may be contrary to the narration of Moses." Possibly some foreword such as this might enable elementary text-books on biology and evolution to conform to Tennessee's legislative educational enactment. It ought, at least, to command the veneration and respect due to antiquity.

After the publication of Schlotheim's book the advance of scientific investigation was rapid, and in paleobotany the work begun by Schlotheim was taken up and continued by Brongniart and

Sternberg, by whom the study of fossil plants was placed upon a firm basis, as a distinct science, coördinate with botany. Most of the earlier works on fossil plants, however, were concerned chiefly with the flora of the Carboniferous Period. In other words, the study and description of fossil plants was merely incidental to the mining of coal, and most of the vegetation that was described and figured was such as happened to be brought to light in connection with economic operations. Very little was attempted along the line of exploring elsewhere merely to unearth fossil plants. It was not until their value as indices of geologic horizons began to be realized and appreciated that they were searched for extensively and systematically in the more recent geological formations. With the establishment of geological surveys, however, the floras of the different geological periods received constantly increasing attention, and the remains of angiosperms and gymnosperms, as well as ferns were described and figured.

Unger, Goeppert, Heer, Saporta, and Ettingshausen in the Old World, and Dawson, Lesquereux, and Newberry in America, from about 1840 to 1880, were among the pioneers in thus enlarging the scope of paleobotany and making it an indispensable adjunct to critical stratigraphic work in geology.

In recent years botanists have been taking a constantly increasing interest in the study of fossil plants, as indices of the evolution of living types of vegetation, and as providing unmistakable proofs of climatic and other changes in various parts of the earth at different periods, and explanations of many puzzling facts of modern plant distribution. Paleobotany is now recognized as an important aid in the critical study of the existing plant life of the earth, and in this connection The New York Botanical Garden was not only one of the pioneers, but has continued to be one of the world's main centers for paleobotanical research, in connection with its constantly increasing collections of fossil plants and literature relating to the subject.

The lecture was illustrated by a series of lantern slides illustrating the earlier attempts to depict fossil plants; critical studies of plant remains by modern methods of sectioning and photography; the practical application of paleobotany in connection with economic geology; etc.

ARTHUR HOLLICK.

IRIS AND ITS CULTURE[1]

The iris is an old garden favorite. One variety, *Iris florentina,* which is one of the sources of the orris root of commerce, was grown at least as early as 1500. In most of the older gardens there was at least a clump of blue or yellow flags. The iris belongs to a large family which is widely distributed and many of its relatives are extremely valuable additions to our garden flowers. Crocuses are among the first plants to bloom in the spring; the gladioli are conspicuous for their beauty in the summer and early fall months; freesias are used extensively for cut flowers.

The iris genus is a very large one and the various species are found widely distributed throughout the north temperate zone; Europe, Asia and North America are represented by a large number of different types. No true irises are found in the southern hemisphere, although some of their relatives are important features of the vegetation.

There have been described about one hundred and sixty species of iris but these can be grouped together into a relatively small number of classes. One broad division is into the bulbous and rhizomatous irises. The former are represented by the Spanish, English, and Dutch varieties, which are grown for cut flowers in the late winter months. The rhizomatous irises include a large number of fairly distinct types, the best known of which are the tall bearded irises which constitute so conspicuous a feature of our gardens. The usual types of bearded irises have been derived from plants found in Central and Southern Europe. In recent years, literally hundreds of new varieties of these irises have been originated and are now grown more or less extensively.

Another large group of irises with rhizomes are the so-called beardless varieties. There are a number of distinct groups of these but the Japanese kinds are best known. These have been developed in Japan and have been transported to other parts of the world.

By judicious selection the blooming season for irises may be a relatively long one. In this vicinity, in a favorable spring, we

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on May 29, 1926.

may have blooms of *Iris reticulata* in the latter part of March; early in April the ordinary dwarf bearded bloom, followed by the intermediate bearded and the tall bearded groups; and with the latter come the Siberian and other types of beardless irises. These are followed in turn by the Japanese, which bloom in the latter part of June and early part of July. Finally, *Iris dichotoma* flowers in the latter part of July and early August.

Irises are adapted for various garden uses. Several are desirable as rock garden plants, as the crested iris, the roof iris, and many of the dwarf bearded. Others, as the Siberian types, may be grown in moist situations. A great majority of the irises, however, thrive best in good garden soil.

The American Iris Society is composed of people who are especially interested in the culture of the iris. Americans are taking a leading part in the development of new and improved varieties. The Society has established test gardens for the study of irises at different places. The test garden at The New York Botanical Garden is devoted primarily to the bearded varieties. At the Brooklyn Botanic Garden the study of the beardless irises, especially the Japanese varieties, is the main feature.

The lecture was illustrated by about eighty colored lantern slides which showed many of the species and varieties of irises, as well as their use in garden plantings.

GEORGE M. REED.

POETRY IN THE NAMES OF FLOWERS[1]

Many of the names of trees and plants are so old they open wide the door of history and reveal man's earliest reaction to the world about him. As some bear the very names they bore in Central Asia and are more or less common to the whole stream of related nations they must have been used not only for centuries but for millennia.

The fascination of the study of plant names has its foundation in two instincts, a love of nature and a curiosity about language. This is botanizing which can be done by the fireside. The names of flowers tell of ancient mythologies and strange superstitions

[1] Abstract of a lecture given in the Museum Building of The New York Botanical Garden, on Saturday afternoon, March 6, 1926.

now almost forgotten. In the names of flowers man has revealed his appreciation of their beauty, and as many of them were named by poets the names will speak to you as do the flowers themselves.

For identification the botanists have given to every known plant a name by which it can be recognized all over the world. These names should always be used when scientific accuracy is sought but for every day use it is thought to sound pedantic. We do not say "Look at that graceful *Betula populifolia*" when we wish some one to admire a white birch!

There should be no antagonism in the use of botanical and popular names as their purposes are quite different, one scientific and one literary. In Britton and Brown's great work, "The Illustrated Flora of the Northern States and Canada" you will find thousands of these vernacular names, many not in any other publication. Dr. Britton says that Judge Brown took great pains in collecting these names from the ends of the earth, as he felt they should be treasured on account of their great age and poetic beauty as well as the fact they had come from the hearts of the people.

These popular folk-names contain history, romance, and poetry as well as foolishness and superstition. To realize what the flowers have been to man, we need only to hear their names. Maeterlink says they "sound like persons in a play, dancers in a fairy scene in the forest of Arden; to call their names is to recite a poem."

No one questions the power of a name to produce personality and most of us realize that the poets by vivid descriptive names have peopled the fields and the forests and gardens. How glad we are to get the call of "Wake-Robin" and to listen to Jack-in-the Pulpit's spring sermon and see Johnny-jump-up, followed by Bouncing-Bet, Black-Eyed Susan, Mary-Gold, and Joe Pye!

The botanical name is assured but many of the favorite flowers have whole strings of meadow names; so, to avoid confusion, we should select the name which most vividly describes the flower and work for its general adoption. This is something which the garden clubs should unite in doing. Prizes might be offered and say five years time given in which to decide upon the most appropriate name for a flower, the poets could help and it would indeed be a high honor to name a flower. There are new flowers

constantly coming into our gardens from foreign lands which need descriptive English names.

In making these names we must not forget that "a true poem is a series of pictures set to music" and the sound of a flower's name should also suggest the flower. This is illustrated by the Greek name "Anemone," the wind flower, which has the softness or a zephyr; and the word "violet" is a song. Names like these should inspire us to give each flower a name worthy of its great beauty. Who was the poet who first called the daisy the "day's eye" and saw in its shining "petals" the rays of the sun?

LAURA LEE ROGERS.

NOTES ON BIRDS IN THE BOTANICAL GARDEN[1]

The speaker was inclined to think that since the advent of so many more automobiles after the opening of the Bronx River Parkway, the water birds especially were becoming scarcer. The pair of Canada geese, however, that were about the year previous, were again trying to raise a brood last year but with no better success, for owing to low water in the arum pond, what had been an island the year before, where the nest was placed, was last spring connected to shore by a dry path and the few eggs laid were destroyed or carried off almost immediately. Among transient visitors to the Garden were the pied-billed grebe, two great blue herons, and a woodcock, none of these remaining more than a day or two.

Of owls at least three species were noted the past season, the screech owl, not heard as often as in the past however, the long-eared owl and a single great horned owl. The last is a winter visitant and has apparently never been heard hooting or screeching in the Garden, doubtless because he has no mate to talk to. This last bird is the one that should truly be called screech owl for his screech, totally different from his rather melodious hooting, is one of the harshest notes one is ever likely to hear in the woods from one ocean to the other. The little screech owl, with his soft, tremulous, melancholy notes, is certainly misnamed if ever a bird was.

[1] Abstract of a lecture given in The Central Display House of Conservatory Range No. 2, on Saturday afternoon, February 6, 1926.

A bird that visited the Garden for the first time in some four years, the quail, brought out a brood again last summer. A nest was found at haying time, containing seventeen eggs and all were hatched July 14. The young were able to fly by August 3, when fifteen were noted and about half this number were recently seen. Two quail eggs shown were from a nest found some four years ago that was placed in a hollow, surounded only by tall grass and at no great distance from the drinking fountain at the foot of the walk in front of the museum building. Although only a rod or two from a much-used path, the presence of the birds was not suspected until the grass was cut down by a machine. The mother bird stayed on the nest till the machine passed over her, then flew out behind, never to return, after what must have been to her a most terrifying experience. The eggs and nest were not injured and were left just as they were for some time, the eggs all finally being destroyed except these two.

Humming birds were scarcely noticed last year in the Garden. Usually one or more pairs are observed nesting. Two different styles of nests were shown, one built on a slender, swaying branch just where it forks, the other placed on the stump of a stout limb, broken off horizontally. Both are covered with the same kind of lichen and bound about more or less with spiders' webs, although the first nest was built in the Garden, the other in Wisconsin.

Chimney swifts were about as usual. Their only breeding place on the grounds however, the chimneys of the Lorillard mansion, have been pulled down. They arrive rather late with us and mostly depart quite early in the fall, yet a few were noted as late as October 13, last year. The winter home of these birds is still a mystery. They collect in great numbers on the north shore of the Gulf of Mexico, suddenly disappear, to return again the following spring, but in what country they have spent the time between, is unknown, at least to the white man.

Various other birds, their nests or eggs, were mentioned more or less briefly and specimens shown by the speaker before closing.

R. S. Williams.

DOCTOR WILLIAM E. WHEELOCK

Through the death of Dr. William Efner Wheelock, on February 3rd of this year, the Garden has lost its first annual member. Soon after provision was made by the Managers for classes of membership in 1895, this action came to Dr. Wheelock's attention and he immediately asked to be enrolled and it was my privilege to enroll him; this membership and his interest in the Garden and in plants generally have been continuous. At that time and during several years he was a diligent student of botany at the herbarium of Columbia College. He had concentrated his attention on the milkworts, genus *Polygala,* and published a monograph of the North American species in the second volume of "Memoirs of the Torrey Botanical Club" in 1891. He also studied plants of the Saxifrage Family and published descriptive lists of them in "Bulletin of the Torrey Botanical Club," volumes 17 and 23, in 1890 and 1896. He was very fond of trees, and planted and observed many at his home at Easthampton, Long Island.

Dr. Wheelock was born in Manchester, England, January 26, 1852, was graduated from Yale University in 1873, and was awarded the degree of Doctor of Medicine by Columbia University, in 1876, and of Bachelor of Laws in 1885. He was a delightful companion, loved and esteemed by all who knew him.

N. L. BRITTON.

NOTES, NEWS, AND COMMENT

The lecture at The New York Botanical Garden on March 20th was delivered by Oliver Perry Medsger, who is a member of the staff of the Newark (N. J.) High School, his subject being "Wild Flowers and their Insect Visitors." The lecture was chiefly the result of Mr. Medsger's own observations, he having spent much time in the field studying and collecting the flowers and the insects that visit them. He finds that the honey-bee does very little in pollinating our native wild flowers, that work being done chiefly by the bumblebees and other native species. Our rich American flora existed thousands of years before the honey-bee was introduced into this country from Europe. Many introduced plants, however, are pollinated by the honey-bee. In the Mint Family

alone there are at least forty-five species in northeastern United States which were brought here from Europe and Asia, the majority of which are pollinated through the agency of the honeybee. To illustrate his lecture, Mr. Medsger used nearly ninety lantern slides chiefly in color. The photos were taken in the field while making his studies. In about twenty of these slides, the insects were shown on the blossoms. An interesting feature was pictures and a discussion of the spiders that conceal themselves in the blossoms with their long yellow front legs sticking up like stamens. As the insects come to the blossoms for nectar or pollen, they are captured by the spiders. In turn these spiders are captured and carried off by the mud-dauber wasps who place them in their nests as food for the young. Mr. Medsger showed a succession of pictures of flowers from the skunk cabbage, the first blossom of spring, to the late autumn bloomers and told what insects visited them and how they pollinated the blossoms.

Edward W. Berry, Professor of Paleobotany in The Johns Hopkins University, Baltimore, Md., gave an illustrated lecture on "The Geological History of Plants" in the Museum Building of The New York Botanical Garden on Saturday afternoon, June 12. Professor Berry emphasized the necessity for plant lovers to obtain the perspective gotten by an appreciation of the extent of geological time, the extended ancestry of existing plants, the evolutionary importance of some of the great extinct groups, and the necessity of considering ancestors in all problems of modern distribution. The ancestors of most of our familiar forest trees go back much further than the family tree of the horse to the far-off age of Dinosaurs. Some of the curious synthetic types of the earliest land plants of the Age of Fishes, and the more significant members of the flora of the Coal Period were described, as well as some of the earlier experiments of plants at increasing their stature and in forming seed-like structures. The speaker also described some of the plants of the Mesozoic Era, or great middle period of plant evolution, especially the extensive group of extinct cycad-like plants. The dawn of the flowering plants in the late Mesozoic and some of the more interesting members of the floras of the Age of Mammals, upon which their evolution as well as that of man and civilization so largely depended, were

dwelt upon in considerable detail. The lecturer closed with an account of the present and past distribution of several of our more interesting forest trees.

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THE NEW YORK BOTANICAL GARDEN
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JOHN K. SMALL

BOTANICAL TRAVEL IN PERU AND CHILE
FRANCIS W. PENNELL

THE SWAMP CYPRESSES
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THE BOTANICAL CONGRESS AT ITHACA
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NOTES, NEWS, AND COMMENT

ACCESSIONS

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THE SAW-PALMETTO—SERENOA REPENS

(WITH TEXT-FIGURES 1–4)

When we consider the great abundance of the saw-palmetto, and its wide geographic distribution—for it stands second among our palms in the extent of area it inhabits and first in abundance—it seems strange that the earlier botanical literature of America is so barren of references to it. The armament of its petioles, unique among our native palms, and the shape of the fruits particularly should have attracted the attention and interest of botanists and travelers.

However, this palm does receive notice in the annals of Florida as early as the end of the seventeenth century in a little book by Jonathan Dickenson.[1]

The following nine quoted paragraphs are from paragraph 5 of the preface and pages 6, 15, 16, 17, 37, 40, 46, and 79, respectively, of that work. There are, perhaps, references to the saw-palmetto in early Spanish records to which we have not access.

". . . Hunger had so far prevailed over them, that they could eat with an Appetite the Palmetto-Berries; the Taste whereof was once irksome, and ready to take away the breath; . . ."

". . . but the Wilderness country looked very dismal, having no trees, but only Sand-hills covered with shrubby palmetto, the

[1] "God's protecting providence, man's surest help and defence, in times of greatest difficulty, and most eminent danger, evidenced in the remarkable deliverance of Robert Barrow, with divers persons, from the devouring waves of the sea, amongst which they suffered shipwreck; and also from the cruel devouring jaws of the inhuman cannibals of Florida." Philadelphia, 1699.

FIGURE 1. Saw-palmetto (*Serenoa repens*), in flower, near Cape Canavaral, Florida. Individual plants at each end of figure and a clump in the center. Although typically simple-stemmed, the saw-palmetto frequently branches. The white flowers are very fragrant. They are much frequented by insects, especially bees. They are the source of vast quantities of honey in peninsular Florida.

Stalks of which were prickly, so there was no walking amongst them;"

"After we had travelled about five Miles along the deep Sand, . . . , on the other side whereof was the *Indian* Town, were little Wigwams made of small Poles stuck in the Ground, which they bend one to another, making an Arch, and covering them with Thatch of small Palmetto Leaves; . . "

" . . an *Indian* brought a Fish boiled, on a *Palmetto* Leaf, and set it down amongst us, making Signs for us to eat; . . ."

"The Cassekey [King] then went into his wigwam and seated himself on his Cabbin cross-legged, having a Basket of Palmetto Berries brought him, which he eat very greedily; . . "

"About Noon some Fish were brought to us on small *Palmetto* Leaves, being boiled with Scales, Heads and Gills, and nothing taken from them but the Guts; but our Troubles and Exercises were such, that we cared not for Food."

". . . . ; the *Cassekey* ordered the Master Joseph Kirle, Solomon Crosson, my Wife and me, to sit upon their Cabbin to eat our Fish, and they gave us some of their Berries to eat; we tasted them, but not one amongst us could suffer them to stay in our mouths, for we could compare the Taste of them to nothing else but rotten Cheese steep'd in Tobacco Juice."

"In some Time after we had been in the House came in *Indian* Women, loaded with Baskets of Berries, mostly of the *Palm*, some Sea-side *Coco* Plums, and Sea-side Grapes; Of the two latter we could eat, but of the *Palm* Berries we could not bear the Taste in our Mouthes: . ."

". . . but having small *Palmetto*, which grew nigh, Joseph Kirle and I set to work and made a shelter, . "

Sixty odd years later a book under the following title by William Stork was added to the annals of Florida:

"AN ACCOUNT OF EAST FLORIDA; WITH A JOURNAL KEPT BY JOHN BARTRAM, OF PHILADELPHIA, BOTANIST TO HIS MAJESTY FOR THE FLORIDAS, UPON A JOURNEY FROM ST. AUGUSTINE UP THE RIVER ST. JOHNS. LONDON, 1765."

There it is recorded that:

". . . ; the palmettos likewise grow pretty plentifully between these middle grounds and pine lands."

" . here was a patch of good swamp, but the pineland approached near the river, and generally a perch or more of Palmetto-ground, gently rising between the swamp and pineland."[2]

[2] Quotations from page 3 of the above-cited work and page 34 of a reprint issued from the office of the Florida Mirror, Fernandina, Florida, 1881.

FIGURE 2. Copious growth of saw-palmetto. Looking from the high barrier dune on Jupiter Island, Florida, toward the lagoon. Hobe Sound and the mainland in the distance. Here Jonathan Dickenson's boat was wrecked in 1696. This is the palm growth about which he records that: "the wilderness country looked very dismal, having no trees, but only sand-hills covered with scrubby palmetto, the stalks of which were so prickly that there was no walking among them."

Although there was not very much written about the saw-palmetto in the early days of exploration in the south, its botanical history did, however, begin shortly after the American Revolution. While the first description and naming of the species is usually attributed to André Michaux[3] in 1803, it seems clear that in reality it should date from about a decade earlier. While William Bartram[4] was on his way to Florida, he observed the palms growing on Saint Simon Island, Georgia. In his account of his observations on the island, he mentions four kinds of palms, all of them referred to under the genus *Corypha—Corypha Palma* (cabbage-tree), *Corypha pumila* (Dwarf-palmetto), *Corypha repens,* with a description ("Dwarf saw-palmetto"), and *Corypha obliqua,* with a description (saw-palmetto). There are many forms of the saw-palmetto. The plants vary much as a consequence of local conditions. Bartram evidently met with the two extreme forms growing in that region, just as may now be found on any of the sea-islands along the coast.

The one is a small plant common in the poor soil of savannahs and low pine wood and growing closely appressed to the ground. The other grows in loose sand, is larger and the stem is often ascending or even erect (FIGURE 4).

There seems to be little doubt that all our forms of the saw-palmetto will have to be grouped under the name *Serenoa repens*

[3] André Michaux was born 7 March, 1746, at Satory, near Versailles. In 1782–1785 he was engaged as a botanical explorer in Persia, and from 1786 to 1796 was occupied with a similar mission in the United States, under the auspices of the French government. He collected both living and dried plants, from Hudson Bay to Florida, and from the Atlantic to the Mississippi, these serving as the basis for his flora of North America, published under the anonymous editorship of Louis-Claude-Marie Richard (1754–1821) in 1803. Meanwhile, Michaux, who had accompanied the French exploring expedition of 1800–05, had died in Madagascar, 13 November, 1802.—JOHN HENDLEY BARNHART.

[4] William Bartram was born 9 February, 1739, at the botanic garden of his father, John Bartram (1699–1777), at Kingsessing, a suburb of Philadelphia, where he spent most of his life. He first visited Florida with his father in 1765; and from 1773 to 1778 was engaged in botanical travels in the Carolinas, Georgia, and Florida, of which an account appeared in book form in 1791. He died at Kingsessing, 22 July, 1823.—J. H. B.

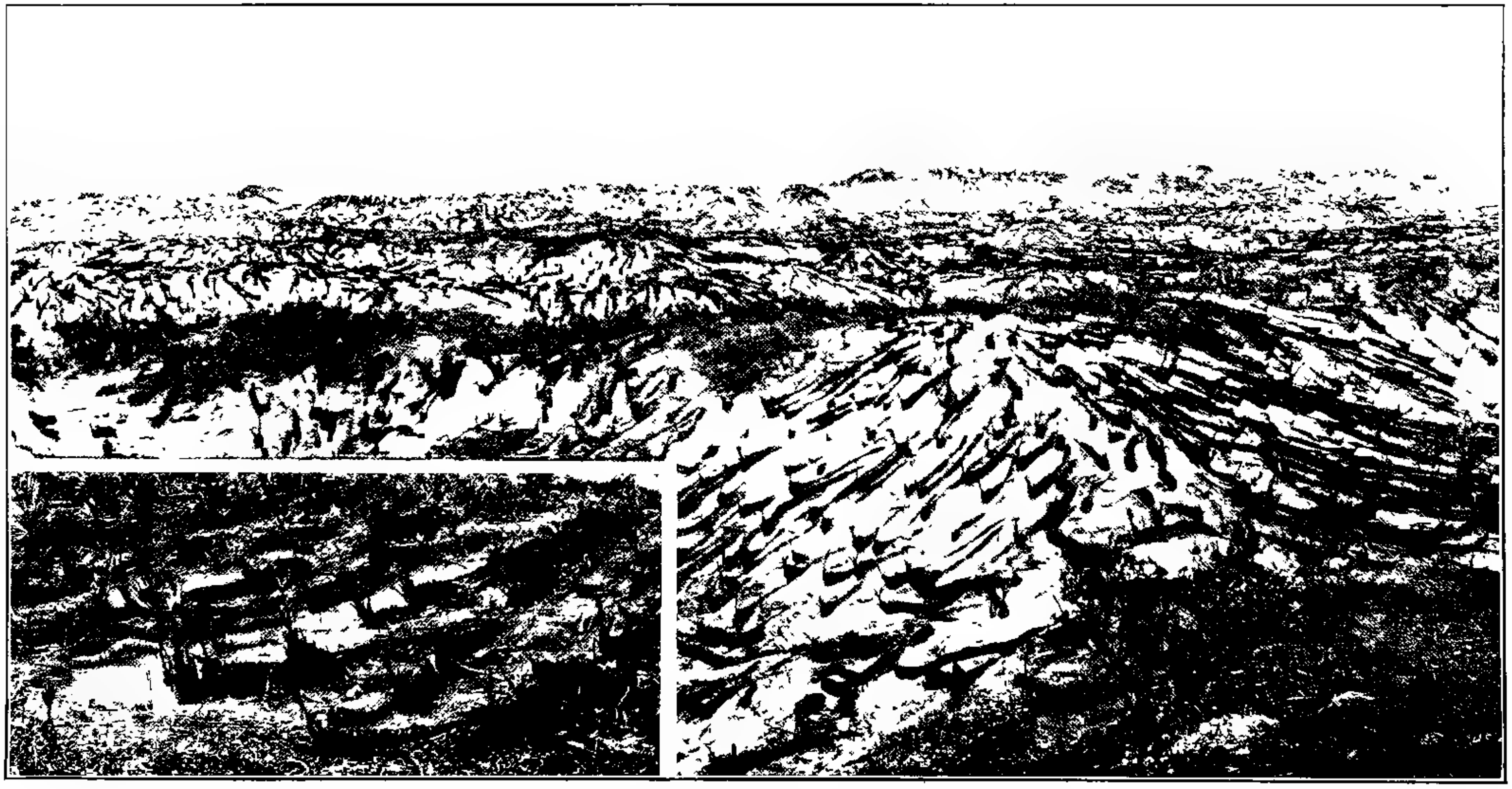

FIGURE 3. Dunes near Mosquito Inlet, Florida, as they look after being swept by fire. View looking east from "Green Mound," a kitchenmidden on the lagoon, Halifax River. The Atlantic Ocean may be seen in the distance. The edge of the midden may be seen in the right corner of the foreground—two white spots are oyster shells. The prostrate and creeping habit of the palm stems is evident, especially in the insert.

unless some one can prove that the assemblage really comprises more than a single species, which is unlikely.

In 1803, André Michaux described the same plant as *Chamaerops serrulata,* giving as its range the maritime parts of Georgia and Florida.[5]

In 1817, William Baldwin,[6] writing from Fernandina, Florida, said:

" Since I have mentioned some of the vegetable productions of this Island, and among others, the *Chamaerops serrulata*—I will make a few observations on this family of plants. Beside the one just mentioned, I am acquainted with three others: viz., *Chamaerops Palmetto, C. hystrix,* and *C. acaulis,* Mx. which is the *Sabal minor* of Adanson. . . It is by no means generally known that the young shoots of the *Chamaerops serrulata* (' Saw Palmetto ') are also eatable—and are even more sweet and tender than the former [*Sabal Palmetto*]. My knowledge of this fact was derived from the late Mrs. Catharine Miller, of Dungeness, on Cumberland Island. This is generally a humble plant, with a short, crooked, prostrate stem, from one to three feet in length: but in some situations—and particularly near the seashore—it attains to the height of 8 or 10 feet, and has an ornamental appearance. It is rarely found north of Savannah river."[7]

Thomas Nuttall[8] records under *Chamaerops serrulata,* that,

[5] Flora Boreali-Americana 1: 206. 1803.

[6] William Baldwin was born in Newlin Township, Chester County, Pennsylvania, 29 March, 1779. He visited China as surgeon on a merchant vessel in 1805, and received his medical degree from the University of Pennsylvania in 1807. From 1812 to 1818 he was a surgeon in the United States navy, most of the time stationed in Georgia or Florida. Appointed surgeon and botanist to Long's expedition up the Missouri, he died at Franklin, Missouri, 1 September, 1819.—J. H. B.

[7] Reliquiae Baldwinianae, 343–344. 1843.

[8] Thomas Nuttall was born 5 January, 1786, at Long Preston, near Settle, Yorkshire. He became a journeyman printer, and early acquired a taste for botany. During thirty-three years of residence in the United States, from 1808 to 1841, he devoted most of his time to botanical study, collecting plants not only in the northeastern states, but in the middle west, the south, across the Rockies and on the Pacific coast, and in Hawaii, and publishing his remarkable little work on the " Genera of North American plants," as well as numerous other important contributions to botanical literature. He also became well known as an ornithologist. In 1841 he returned to England, and made his home at " Nutgrove," a small estate near Rainhill, Prescot, Lancastershire, where he died 10 September, 1859.—J. H. B.

FIGURE 4. In pinewoods east of Tampa Bay, Florida. Saw-palmetto growing erect, as it frequently does, contrary to its normal prostrate habit. Why it should locally assume an erect habit is a problem. An erect trunk may originally have been its habit of growth, and individual plants may thus record an ancestral character. On the other hand, it may contain blood of the cabbage-tree (*Sabal Palmetto*), with which it frequently grows, sufficient to cause stems to grow erect.

"The central part of the caudex is more edible than that of the preceding [*Sabal Palmetto*] Dr. Baldwyn. Margin of the stipe serrated with short spines; drupe solitary oblong, nearly twice the size of that of *Sabal Adansoni,* which it resembles in every other respect."[9]

The saw-palmetto did not induce our early botanists to write as much concerning it as some of our other palms did. Perhaps, this state of affairs is accounted for by the fact that the center of development of the species was inaccessible to these travelers. Most of them saw it only in the northern edge of its range. None of them saw it at its best.

The saw-palmetto stands at the head of the list of our palms as far as abundance is concerned. It stands second in area of distribution. Its geographic range extends from extreme southern South Carolina to southern Florida and Mississippi. Like three of our other low-growing palms—*Rhapidophyllum, Sabal Etonia, S. minor*—it is now endemic in the southeastern United States. What its prehistoric distribution was and whence it came are mysteries that will remain unsolved. It has no close relatives, and it is quite different in its characters from the other armed-petioled palms of Florida and the West Indies. It evidently, however, came directly or indirectly from the West Indies. If its ancestors were Antillean or Floridian, these are lost. Southern Florida was evidently its seat of origin or landing place, for northward and westward its growth, both individual and *en masse,* gradually tapers off.

In the stiff soils towards the extremities of its geographic range, especially where fire is frequent, the plants are often puny and limited, in the sandy soils they are robust and prolific. This condition has led to the temporary recognition of more than one species.

The saw-palmetto is typically a prostrate plant. Ages ago it may have been erect. In its early existence it may have been a more tender plant and then for the purpose of self-preservation it may have come to lay its stem prostrate and anchor it with numerous roots so as to be more immune from fire and other destroying conditions, just as many other plants seem to have done, particularly in fire-swept regions (FIGURE 3).

[9] The Genera of North American Plants 1: 231. 1818.

As intimated above, its stems are not always prostrate. In localities protected from fire, such as stream-banks, and barren coastal sand-dunes, one often finds groups and even groves of these palms with erect stems growing up to twenty-five or thirty feet tall (FIGURE 4).

The saw-palmetto has several unexplained peculiarities of growth. It seems to grow best in loose sand seemingly devoid of nourishment. It prefers dry soil, but it does grow in marshes throughout its range and in wet sink-holes on the lower Florida Keys. Further, the saw-palmetto abounds in pineland, on prairie, and in hammock. In the latter, being protected, the plants are often erect and sometimes much branched. In the pine woods the plants are usually quite evenly distributed; in the prairies they are collected into irregular or circular "islands" ranging from a few square feet to many acres in extent.

The plant is one of the two most characteristic and abundant vegetable elements of the "scrub," the other conspicuous plant there being the spruce-pine (*Pinus clausa*). Along the eastern coast of Florida the saw-palmetto has, usually, light-gray or nearly white foliage, and is very prominent among the other vegetation, especially in contrast with the pine trees and the deep-green rosemary (*Ceratiola ericoides*).

Like the cabbage-tree, the saw-palmetto is amphibious, and it also thrives in the various kinds of water within its range, which are represented by soft and hard, acid and alkali, and fresh and salt.

JOHN K. SMALL.

BOTANICAL TRAVEL IN PERU AND CHILE[1]

The speaker has long been interested in the plant-life of the Andes, having twice visited Colombia and the northern Andes for botanical work, spending over a year in that country. The expedition now described, in 1924 and 1925, was to the middle and southern parts of the Andes, passing seven months nearly wholly in Peru and Chile. On the trip he was accompanied by Mrs. Pennell, and a niece, Miss Sara M. Pennell.

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on March 27, 1926.

The lecturer told first of the physical background of western South America, of the length and height of the Andes and the narrow belt between the Cordillera and the Pacific Ocean. Then some mention was made of the remarkable early Amerindian cultures both of the coast and of the Andean highlands, the greatest and most recent of which was the Inca empire. We owe to the Indian agriculture a surprisingly large number of our important food plants.

After attending as a delegate from the Academy of Natural Sciences of Philadelphia the Third Pan-American Scientific Congress, held at Lima, Peru, in December, 1924, about six months were spent in field-study and plant-collecting. In company with two botanists of the National Museum of Chile, an excursion was taken from Santiago in the arid portion of central Chile, south into the forest and eventually to the island of Chiloë farther south of the equator than New York is north of the line. Here, shel tered by the Andes and kept wet by nearly constant rains, is a luxuriant forest, with air-plants and a heavy undergrowth of vines and bamboos. No part of the journey was into more beautiful scenery than the few days' visit to the lakes of southern Chile, a district justly called "The Switzerland of South America." These lakes of clearest green water are surrounded by high snow-peaks, including among them Osorno with its perfect volcanic cone, and Puntiagudo with twisted corkscrew-like summit.

In Peru, to which return was made after the phenomenal and unprecedented rains of 1925, collections were made in both the southern and central parts of the country. Around Arequipa, placed at the foot of three snow-peaks, were many plants growing in soil which for many years at a time may be scarcely or not touched by rain. The plants obtained included many delicate annuals, the seeds of which must be able to rest for years awaiting the occasional year when rain falls. Of course many of these plants have probably never been obtained before by scientists.

After climbing to snow on Chachani, the highest snow-peak above Arequipa, the party ascended by railroad to the "puna" or bleak table-land on which is Lake Titicaca. The plants collected there were the most uniformly dwarfed that the speaker had ever seen, more so even than those that grow high above timber-line

on the Andes of Colombia. On the puna were seen the picturesque and brightly attired Quichua Indians, with hats differing curiously in each section. Here too were the animals that the ancestors of the Quichua Indians had domesticated centuries ago, the llama used as a beast of burden and the alpaca raised for its fur. The railroad to Cuzco passes across a range of the Andes close beneath the glacier of the mountain Vilcanota.

Pictures were shown of Cuzco, the former Inca capital, and of Inca ruins on Sacsaihuaman on the hill overlooking Cuzco and at Ollantaitambo, reached by several hours railroad ride down the Urubamba river. The most noteworthy enterprise of the entire expedition was a nine days' collecting trip, made by mule-back riding, across two ranges of the Andes from Cuzco eastward into the luxuriant forest of the eastern slope of the Andes. This trip was made into country which seems to have been scarcely visited before for scientific collecting, and of the Scrophulariaceae, or snapdragon family, of which the speaker is making a special study, about half of the species obtained will probably prove new to science. Large collections of plants of all families were gathered, which will doubtless prove as interesting on study. Entrance into the forest was made by a new trail, just a meter wide, which is being cut over stream-courses and along the rocky sides of steep cliffs. The trail has now descended the eastern slope of the Andes to 2,000 meters altitude, and beyond this it is faced by the necessity of blasting its course for a mile or more of solid rock-face and then must descend into a forest where the engineers are having to dispute its entrance with naked savage Indians who shoot poisoned arrows. As the Peruvian trails are never guarded, even though a fall from the edge would mean a drop of a thousand feet to a roaring river, riding on such a narrow course is sufficiently exciting.

In central Peru the expedition visited several places around Lima, localities which are important as being those that were first visited in colonial days by the expedition of Ruiz and Pavon sent out by Carlos III of Spain about 1778. Particularly interesting were the collections made at Canta, a town back in the Andes northeast of Lima, once an important place on the trail over the Andes, but rarely visited since the building of the railroad from Lima inland to another pass some fifty miles farther south. Life

in Canta is simple but hospitable, and in June the high mountain-slopes on every side were still clothed with verdure. Particularly in ravines and by cascades were many plants. About Canta and its neighboring towns, and high up to over 4,000 meters, rich collections were made, including many species of Calceolarias and other plants. Although most of the plants gathered at Canta have likely been known to science for a century, probably only a small portion of them have been represented in the herbaria of the United States. So it is worth our while to obtain these. But at Canta many species were found which were not described by Ruiz and Pavon and even here were obtained some species new to science.

The collections of the expedition were made on behalf of The New York Botanical Garden, the Academy of Natural Sciences of Philadelphia, Harvard University, and the Field Museum of Natural History in Chicago, the last of which is especially interested in the botanical exploration of Peru.

FRANCIS W. PENNELL.

THE SWAMP CYPRESSES

Professor Augustine Henry and Mrs. Marion McIntyre have recently published in "Proceedings of the Royal Irish Academy" (**37 B**: 90–110, *pl. 1–8*) results of long-continued studies upon "The Swamp Cypresses, *Glyptostrobus* of China and *Taxodium* of America, with notes on allied Genera"; they have kindly presented a copy of this work to our library.

Glyptostrobus, an ancient genus of coniferous trees, whose remains occur in Tertiary rocks in Europe, Asia, and North America, has now but one living species, unknown in the wild state, but existing in two small areas in China near Canton and Foochow, where it seems to have been preserved in cultivation, through the superstitious beliefs of the people; its geological history is discussed in detail. This "water-pine" of the Chinese (*Glyptostrobus pensilis*) produces "knees" from its roots, similar to those of our Swamp Cypresses (*Taxodium*) and the two genera are similar in other respects, but differ in detailed characters of flowers, cones, leaves, and wood. In *Glyptostrobus* and

in some Taxodiums the trees become bare or nearly bare of leaves in winter, by the peculiar deciduous branchlets, this habit having given one of the trees of the southeastern United States the well-known name " Bald Cypress."

Glyptostrobus is one of the rarest cultivated trees in Europe, climatal conditions being unfavorable for it, but record is made of one about 15 feet high at Nymans, Sussex, England; it exists, under glass at the botanical gardens at Kew, England, and at Glasnevin, Ireland.

The geological history of *Taxodium* is not discussed by Professor Henry and Mrs. McIntyre; Dr. Arthur Hollick has given me data, however, that indicate its distribution in the Tertiary to have been at least as broad in the northern hemisphere as that of *Glyptostrobus.*

There are three living forms of *Taxodium,* all North American.

(1) The Bald Cypress (*Taxodium distichum*), which has a natural range in the wild state from New Jersey to Florida, Indiana, Missouri, and eastern Texas, and is hardy in cultivation as far north as Massachusetts; trees planted at The New York Botanical Garden in 1904 are now about 40 feet high; the linear leaves are widely spreading, from about half an inch to nearly two inches long; its bark is rather thin.

(2) The Pond Cypress (*T. adscendens*) inhabits the coastal plain from the Dismal Swamp in southern Virginia to Florida and Mississippi; it has proved to be hardy at New York, where trees planted at the Botanical Garden in 1901 are now about 22 feet high; its mostly awl-shaped leaves are less than half an inch long and closely appressed to the branchlets; its bark is thick and furrowed. Both *Taxodium distichum* and *T. adscendens* drop their leaf-bearing twigs in the late autumn. There has long been difference of opinion among botanists and dendrologists as to the status of *T. adscendens,* field students mostly considering it a species distinct from *T. distichum,* while herbarium students have often concluded that it is merely a variety.

Dr. John K. Small, who has studied these trees over most of their geographic distribution, maintains them as distinct species and as they grow side by side at The New York Botanical Garden and in proximity at many places in the south, they seem different enough, although it must be admitted that the flowers and

the cones of the two are very much alike. On this point the conclusion reached by Dr. Henry and Mrs. McIntyre is that *T. adscendens* is a sport of *T. distichum;* if this is the true interpretation of the case, it is, perhaps, the most widely distributed and abundant sport known in the wild state. In southern Florida, there are many square miles densely inhabited by *T. adscendens* to the exclusion of *T. distichum.* Lower branches of the tree sometimes bear foliage quite like that of *T. distichum;* we observed this interesting feature some years ago, on one of the trees at The New York Botanical Garden when it was about twelve feet high; we took it to be a vestigial character of its ancestor, *T. distichum.*

Dr. Small has obtained, during visits to the southern states, much additional museum and herbarium material which will now be transmitted to Dr. Henry at Dublin to aid his further studies.

(3) The Evergreen Swamp Cypress, "Arbol de la noche triste," of the Mexicans (*Taxodium mucronatum*) differs from the *T. distichum* and *T. adscendens* in its branchlets being persistent, the tree thus evergreen, and its cones are smaller and otherwise somewhat different. Until recently this tree has been supposed to be confined to Mexico, but we now have museum and herbarium specimens from extreme southern Texas. This tree was germinated from Mexican seed at the Insular Agricultural Experiment Station of Porto Rico and had reached a height there of about five feet in March, 1924; it was subsequently transplanted to the nurseries of the Porto Rico Forest Service.

N. L. Britton.

THE BOTANICAL CONGRESS AT ITHACA

The International Congress of Plant Sciences (Fourth International Botanical Congress) held at Ithaca, New York, August 16–23, 1926, proved more successful than its promoters could have hoped. Nine hundred persons were registered as members of the Congress, while the wives and families who accompanied some of these brought the total number in attendance well above a thousand. Those in charge of the arrangements (mostly local Cornell University men) were untiring in their efforts to pro-

vide accommodations and entertainment for everyone, and are to be congratulated upon the results.

Of the nine hundred registered members, more than a hundred were drawn from the large botanical faculty and the advanced students of Cornell; about 650 others came from all parts of the United States, including Porto Rico, Hawaii, and the Philippines. There were about forty from Canada, and more than a hundred from other foreign countries. At least the following nations were represented by more than one delegate: Germany, Sweden, England, Russia, Japan, Switzerland, China, Australia, Holland, Poland, Czecho-Slovakia, Italy, and Brazil. These were represented by at least one each: Denmark, Austria, Esthonia, Jugo-Slavia, Roumania, Bulgaria, Sierra Leone, Nigeria, India, Cuba, Haiti, Trinidad, Mexico, and Panama.

The Congress was divided into 14 sections; thirteen of them indicated by letters: (A) Agronomy; (B) Bacteriology; (C) Cytology; (D) Morphology, Histology, and Paleobotany; (E) Ecology; (F) Forestry; (G) Genetics; (H) Horticulture; (I) Physiology; (J) Pathology; (K) Pharmacognosy and Pharmaceutical Botany; (L) Taxonomy; and (M) Mycology; the fourteenth consisted of the members of the Association of Official Seed Analysts, who registered as members of the Congress and met as a section of it. Some of the sections, such as G, J, and M, were very large, while the smallest was K; but all had attractive programs, and were largely attended. Most if not all of the sections had a sectional dinner some evening during the week, and the botanical members of the National Academy of Sciences gave a luncheon in honor of some of the distinguished visitors from abroad. The Congress opened with a general session, and several business sessions were called in which all of the sections participated; there were also several evening lectures of general interest. Most of the scientific program, however, centered in the sectional meetings, two or more sections combining from time to time to consider matters of mutual concern.

The various excursions planned to points of botanical interest in the vicinity of Ithaca were mostly carried out, but the unfavorable weather conditions that prevailed throughout the week made these the least satisfactory part of the program. Other excursions of a more extended nature—one as far west as the

Yellowstone National Park—were arranged to follow the close of the Congress.

Eight members of the staff of The New York Botanical Garden attended the Congress, Drs. Howe, Stout, Rydberg, Gleason, Seaver, Hollick, Barnhart, and Rusby. Mrs. Seaver and Mrs. Barnhart accompanied their husbands.

JOHN HENDLEY BARNHART.

THE INTERNATIONAL CONFERENCE ON FLOWER AND FRUIT STERILITY

An International Conference on Flower and Fruit Sterility was held August 12–14 under the auspices and with the financial support of the Horticultural Society of New York.

The organization of this Conference was in the charge of an Executive Committee consisting of Dr. N. L. Britton, Chairman; Mr. Frederic R. Newbold, Treasurer, and Dr. A. B. Stout, Secretary, and a Local Advisory Committee consisting of Professor R. A. Harper and Professor H. M. Richards, of Columbia University; Dr. C. Stuart Gager, Director of the Brooklyn Botanic Garden; Dr. William Crocker, Director of the Boyce Thompson Institute for Plant Research, and Mr. Leonard Barron, Editor of "Garden and Home Builder." The Entertainment Committee for the Conference consisted of Mr. John Scheepers, Chairman; Mrs. Harold Irving Pratt, Mrs. Samuel Sloan, Mr. T. A. Havemeyer, and Mr. W. R. Coe. The Hotel Roosevelt was headquarters.

The Conference met in six sessions. The one of the forenoon of August 12 was held at Columbia University in the auditorium of Schermerhorn Hall and the session of that afternoon was held in the Lecture Hall at The New York Botanical Garden. On the 13th the Conference met for two sessions with the Boyce Thompson Institute for Plant Research in Yonkers. The sessions of the 14th were conducted at the Brooklyn Botanic Garden. On the evening of the 13th an informal gathering and smoker was enjoyed at the Hotel Roosevelt.

The opening address to the Conference was given by Dr. N. L. Britton, Chairman of the Executive Committee, and the address

of welcome, from Mr. T. A. Havemeyer, President of the Horticultural Society of New York, was presented by Mr. Frederic R. Newbold, Secretary-Treasurer of the Horticultural Society. A total of 44 papers were presented in the sessions of the Conference and 24 others were read by title. These papers covered a wide range of matters pertaining to sterility and fertility in plants. In general they were concerned (a) with botanical and scientific studies of sterility and fertility, (b) with the occurrence of sterilities in floricultural plants, horticultural fruits and vegetables and agricultural crops, with a consideration of the practical problems that are involved, and (c) with the heredity and genetics of self- and cross incompatibility. Persons from England, Holland, Sweden, Germany, Russia, Poland, Japan, Canada, and numerous states of the United States appeared in the program and papers from Norway, Switzerland, and France were read by title. Distinguished botanists from other countries of Europe and from the Tropics and Hawaii were also present. The attendance at the various sessions averaged over one hundred persons.

The Horticultural Society of New York is planning to publish the proceedings of the Conference as a volume of its Memoirs.

A. B. STOUT,
Secretary, Executive Committee.

MRS. W. GILMAN THOMPSON

Harriet Howard Pomeroy Thompson, wife of Dr. W. Gilman Thompson, formerly president of The New York Botanical Garden, died on May 27, 1926. It was at their residence that the Woman's Auxiliary of the Garden was organized on February 3, 1914, and Mrs. Thompson was a member of its Council and had served on various committees with zeal and intelligence. She took great interest in gardening and at her various homes in the city and the country gave it her personal attention and achieved some beautiful and interesting results. She published a Garden Record, intended to serve for memoranda covering three years and had a very good library of modern books on gardening. She was an active member of the Lenox Garden Club, served for

many years on its program committee and took part in the conservation of the native flora of the Berkshire region, in which she spent most of her summers. Besides these interests, Mrs. Thompson was one of the founders of the New York Exchange for Women's Work and had been one of its vice-presidents for many years. She was also a member of the National Society of Colonial Dames and had been a member of its Board of Managers, being the fifth in descent from William Pitkin.

Her father, John Norton Pomeroy, and her brother, Professor John Norton Pomeroy, Jr., had compiled and edited a voluminous and standard compendium on legal cases and precedents and Mrs. Thompson shared in the family lustre, having a keenly critical literary sense and a retentive memory.

Her kindly interest and help will be greatly missed in the Advisory Council of The New York Botanical Garden and we tender our sincerest sympathy to Dr. Thompson and the members of her family.

ELIZABETH G. BRITTON,
Honorary Curator,
The New York Botanical Garden.

PUBLIC LECTURES DURING SEPTEMBER AND OCTOBER

Below may be found the program of the Saturday afternoon lectures during September and October. They are given in the Museum Building of The New York Botanical Garden at 4 o'clock. Doors are opened at 4:15 to admit late-comers.

Sept. 4.	"In British Guiana Jungles,"	Dr. H. A. Gleason
Sept. 11.	"Bolivian Trails,"	Dr. Orland E. White.
Sept. 18.	"North American Arctic-Alpine Vegetation,"	Prof. Geo. E. Nichols.
Sept. 25.	"Dahlias,"	Dr. Marshall A. Howe.
Oct. 2.	"The Royal Botanic Gardens at Kew, England,"	Dr. Arthur W. Hill, Director.
Oct. 9.	"Autumn Colors,"	Dr. A. B. Stout.
Oct. 16.	"Autumn Flowers,"	Dr. G. Clyde Fisher.
Oct. 23.	"Difficulties in Propagation,"	Dr. William Crocker.
Oct. 30.	"Botanizing in Trinidad,"	Dr. Fred J. Seaver.

NOTES, NEWS, AND COMMENT

Dr. Marshall A. Howe gave an illustrated lecture on "Reef-building and Land-forming Plants" before the staff and students of the Marine Biological Laboratory at Woods Hole, Mass., on the evening of August 3.

We are informed by Juan T. Roig of the planting of a small botanical garden at the high school of Pinar del Rio, western Cuba, this being the first collection of living native plants assembled in that province. As there are many species endemic in that region, their cultivation will be of much interest, and visitors will have convenient opportunity to observe them, while the pupils will have an important addition to their curriculum. Dr. Roig tells us that the garden was built and the plants brought together by the teachers and students. There are already about 1000 plants in the ground and 800 in pots.

Meteorology for July. The total precipitation for the month was 6.19 inches. The maximum temperatures recorded for each week were 95.5° on the 10th, 88° on the 17th, *102° on the 22nd* and 87° on the 30th. The minimum temperatures were 58° on the 8th, *52.5° on the 12th,* 62° on the 20th and 57° on the 27th.

Meteorology for August. The total precipitation recorded at The New York Botanical Garden for the month was 6.52 inches. The maximum temperatures for each were *98° on the 3d,* 95° on the 11th, 86° on the 17th, and 95° on the 29th. The minimum temperatures were 61° on the 9th, 60° on the 10th, *57° on the 22d,* and 59½° on the 28th.

ACCESSIONS

LIBRARY ACCESSIONS FROM JANUARY 1 TO JULY 15

Acta societatis regiae scientiarum upsaliensis. 1740, 1744–50. Stockholmiae, 1744–51. (Given by Mr. K. K. Mackenzie.)

AGAR, MADELINE *Garden design in theory and practice.* Philadelphia, 1912.

ANGIER, BELLE SUMNER. *The garden book of California* San Francisco, 1906.

ARBER, AGNES (ROBERTSON). *Monocotyledons; a morphological study.* Cambridge, 1925.

BASSETT, MARY E. (STONE). *Judith's garden.* Boston, 1902.
BEALS, KATHARINE M. *Flower lore and legend.* New York, 1917.
BERRY, EDWARD WILBER. *Tree ancestors; a glimpse into the past.* Baltimore, 1923.
BONAR, LEE, HOLMAN, RICHARD MORRIS, & ROUSH, LOUISE *A laboratory guide for a course in general botany.* New York, 1925.
Botanique de la jeunesse. Paris, 1812.
BOWER, FREDERICK ORPEN. *Plants and man.* London, 1925. (Given by the author.)
BOYLE, ELEANOR VERE (GORDON). *A garden of pleasure.* Boston, 1895.
CALDWELL, OTIS WILLIAM, & SLOSSON, EDWIN EMERY, *eds. Science remaking the world.* Garden City, 1923. (Given by Mrs. N. L. Britton.)
CAMPBELL, DOUGLAS HOUGHTON. *An outline of plant geography.* New York, 1926. (Given by Dr. N. L. Britton.)
CASTLE, AGNES SWEETMAN, & CASTLE, EDGERTON. *Our sentimental garden.* Philadelphia, 1914.
Catalogue of the printed books and pamphlets in the library of the Linnean society of London New ed. London, 1925. (Given by Dr. N. L. Britton.)
CHILD, CHARLES MANNING. *Senescense and rejuvenescence.* Chicago, 1915.
[CHAPPELL, MARION.] *Gardening don'ts.* New York, 1913.
———. *More gardening don'ts.* New York, 1913.
COAN, CLARENCE ARTHUR. *The fragrant note book: romance and legend of the flower garden and the bye-way.* New York, 1917.
COLEY, MAY, & WEATHERBY, CHARLES ALFRED. *Wild flower preservation; a collector's guide.* New York, ©1915.
Curtis's botanical magazine a new edition with amended characters of the species . . arranged according to the natural orders. By W. J. Hooker. Vol. 1. London, 1833.
DANA, FRANCES THEODORA (SMITH). *According to season.* New York, 1894.
DAVY, JOSEPH BURTT. *A manual of the flowering plants and ferns of the Transvaal with Swaziland, South Africa.* Part 1. London, 1926. (Given by Dr. N. L. Britton.)
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THE BIRCH LEAF-MINER
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NOTES, NEWS, AND COMMENT

ACCESSIONS

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THE SURVIVAL AND PROTECTION OF HARRIED FLOWERS[1]

All of us who appreciate the beauty, delicacy, and fitness of our native flowers, flowering shrubs, and trees, in their natural surroundings, have long been concerned over the threats to their existence owing to the ruthless collection of species of particularly attractive and conspicuous habit, either for commercial purposes or for casual collection. The danger to such species has been increased in the past twenty years, since the development of the automobile, which has taken people more and more into the country, and opened to careless gathering of plants wider areas of roadside and fields.

It must be considered, however, that there are other causes which threaten our more delicate native plants, for which the florists and the thoughtless flower-pickers can not be blamed, some of which are still operative. First was the clearing of large areas of forest land for cultivation, which destroyed the conditions required for woodland plants, but in the East this disturbance of original relations of light and shade has largely ceased, and in many regions, with the abandonment of farms and the development of state parks and forests, forest cover is now increasing. Second is the damage from forest or brush fires, which, while better controlled than formerly, still do large damage annually. From my observations of the forest lands in such regions as the Hudson Highlands and the Ramapos, I believe that the spring and fall brush fires do much more in the way of destroy-

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday, July 3, 1926.

ing and preventing the reproduction of the more delicate species than do the thoughtless flower pickers along the roadsides, and such fires do this harm in regions which ordinarily escape the attention of careless collectors. Occurring in April or May, as they do, when rainfall is under normal for the period, they catch tender buds and leaves, scorch them beyond recovery for the season, and by burning the humus often destroy bulbs or rootstocks or other root systems so extensively as to exterminate sensitive species over large areas. I have often noticed that in areas of open woods, subject every spring or even every other spring to brush fires in the leaves fallen from the hardwood trees, the herbaceous flora and the low flowering shrubs seem to lessen in variety of species and what remains is often of a less attractive and interesting character. The characteristic early spring flowers, like bloodroot, hepatica, Dutchman's breeches, purple lady's slipper, columbine, and wake Robin, are scorched to death in their early succulent budding stages, and serious damage is also done to the undershrubs, like *Azalea nudiflora,* variously called pinxter flower and wild honeysuckle, and to the mountain laurel. The later budding plants, which escape the spring fires, have an advantage in sending up their shoots after this annual danger, and the result is seriously to diminish the delicate spring blooms, and to establish more firmly every year such summer and fall plants as the wood asters and goldenrods, tick trefoil and false foxglove, interesting enough, but to my mind not so attractive nor so much in need of protection as the April and May blooms.

The original balance of nature in the hills north and west of New York City has suffered many disturbances since the middle of the eighteenth century, when the first large timber cutting began. The Hudson Highlands and the Ramapos once sustained a heavy coniferous forest, with white pine and hemlock predominating. We read in Boynton's History of West Point that when General Kosciusko built the defenses of that post in 1778 he buoyed the great iron chain across the Hudson at Constitution Island with white pine logs four feet in diameter, cut close by on the bank. A sketch of the Highlands made at the time by Major Villefranche shows the first wholesale cutting in these mountains, when for two miles around every tree was felled to give clearance for observation and artillery fire, as well as for material for con-

struction. With the opening of iron mines and the establishment of charcoal burning for fuel for the furnaces, which began before the Revolution and rapidly extended in the first half of the nineteenth century, the forests were speedily cut off. Oaks, maples, beeches, and other hardwoods, which had previously occupied the valleys, succeeded the conifers almost exclusively. The hardwood forest was cut over thereafter, every thirty or forty years, for fuel for the charcoal furnaces or for the brickyards along the Hudson. These cuttings were usually clean, without thought of leaving young trees, as sprout growth could be depended on for renewal. The result of these frequent openings of large areas to sunlight, the destruction of the original deep forest humus from erosion and from fires, caused frequently recurring difficulties for the more sensitive species which the resilience of Nature was hard put to combat.

Another blow to the balance of Nature was the blight to the American chestnut, the Asiatic fungus imported thirty years ago on Japanese trees, which rapidly spread to native chestnuts and is destroying the tree, against any present prospect of remedy, all along its range from New England to Georgia. Chestnuts made up the majority of our nearby forests in the period after the conifers were cut and hardwoods took their place. In many of the valleys in the Highlands and Ramapos they constituted seventy per cent of the trees. I can remember, twenty years ago, when the most conspicuous feature of the forest landscape seen from any of the summits of the Hudson Highlands, in June, was the greenish yellow catkins of the chestnut blossoms. Now it is hard to find any blossoms, and even if they do bloom the deadly blight will often destroy the trees during the summer and they bear no fruit. The sudden destruction of these large stands of chestnut, which were mostly in the stage of sprouts from old stumps five to twenty years old from the last cuttings, likewise opened to sunlight areas where plants which prefer shade had flourished, and made their persistence difficult, while the standing dead trunks and the fallen trees greatly increased the annual fire hazard.

In the face of these recurring conditions of difficulty of survival and propagation it is not surprising that many of the plants requiring shade and undisturbed humus have largely disappeared

from our immediate region. It is often noticeable, in reports of unusual plants found by earlier botanists and collectors, that such species have not been found recently in their old stands; changes of various kinds have destroyed them, and conditions have not encouraged their re-introduction and survival.

But there is good ground for hope in some recent tendencies that sanctuaries for our more delicate plants may be provided, and that Nature will be given a chance gradually to restore our native flora to the richness and variety of two centuries ago. One of the greatest influences was the abandonment of the iron industry in the highlands of southern New York and New Jersey, which was made unprofitable by easier worked ores in Michigan and Minnesota. With the closing of the mines the frequent cutting of the forest for charcoal ceased, and the exhaustion of the beds of brick clay along the lower Hudson led to a lessened demand for cordwood. The hardwoods were allowed to grow again, and the hemlock began to return along the cliffs and streams. The white pine was so far gone that only scattering specimens remain, and its restoration must be by artificial planting. The woodland flowers, the orchids, hepatica, bloodroot, and others had a respite and began slowly to retake their old stands.

The accumulation of large holdings of forest land, in such large estates as those previously existing in the Hewitt family, and gathered in more recent years by the New Jersey Zinc Company and by the late Edward H. Harriman, and their treatment, under the influence of growing education in scientific forestry, in more reasonable management, gave wide sanctuaries for wild life, floral as well as faunal. And, in 1910, when Mrs. Edward H. Harriman, widow of the railroad developer, gave ten thousand acres of the wooded hills in the central Hudson Highlands, as his memorial to initiate the Harriman State Park, now increased to forty thousand acres, there was established a preserve for plants, which is becoming a safe stronghold for native species and a center for their gradual distribution.

The program of nature study among the summer campers in this park, under the direction of Miss Ruby M. Jelliffe, superintendent of the camping department, is yearly spreading education in conservation of wild life among the hundred thousand boy and girl and adult vacationists in the Park. Collection of flowers for

instruction is limited to one specimen for each group, and the system of nature trails with living examples properly labelled gives the best kind of teaching without destruction of plant material. The establishment last year of the camp of the American Museum of Natural History, under Dr. Frank E. Lutz, who originated the idea of nature trails, showed to thousands how botany may be studied in the field without gathering or handling plants.

The natural restoration of the more unusual native plants throughout the Harriman State Park is being assisted by the General Manager, Major W. A. Welch, in the planting of various species, under the direction of the park forester, Raymond Adolph. Special attention is being paid to the fringed gentian, the seeds of which are gathered and planted in spots where there is not much recreational use, and where the plant may reestablish itself. Berry- and nut bearing shrubs and trees are being planted for food for game.

I have seen several encouraging examples of a return of plants which are threatened everywhere and which suffered in the general disturbance of soil and light conditions in the Highlands before the Park was established. The trailing arbutus is slowly coming back, especially along old and abandoned woodroads. The purple lady's-slipper is holding its own; it blooms fortunately before the height of the season for summer visitors, and where fire does not char the ground and injure its roots it is slowly increasing. I recently saw a colony of about forty plants, within an area a rod square, with a dozen filled-out seed capsules, on a remote hilltop in the Ramapo section. The showy orchis is reappearing, and I know of a colony of hundreds of plants less than a mile from a busy highway, but in a spot little likely to be reached by careless collectors. There is a colony of Pogonia in a bog in the Ramapo plateau, with pitcher plants and sundew and the handsome bladderwort, *Utricularia cornuta.*

Outside such preserves, of course, collection of attractive plants for commerce and for casual satisfaction seriously threatens many species. Arbutus has been exhausted in stands large enough for annual picking by dealers, in many parts of the Pine Barrens of New Jersey, and berry-bearing holly has been much ravaged. But the bogs of the Barrens offer an ample sanctuary for many native orchids, which have almost disappeared from other parts

of the state, and any one who visits the region in the heat of midsummer will find meadows studded with hundreds of the larger white fringed orchis, and the Limodorum, or butterfly orchis, is common throughout Ocean County. The inner side of the dunes on the Great South Beach of Long Island is a seldom invaded refuge of many interesting plants, Arethusa, Pogonia, and the seapinks.

The example of Dr. George F. Norton, in collecting the seeds of the fringed gentian and sending them to any one who will plant them, which has restored this beautiful autumn plant to many Westchester meadows where it had once grown, and from which ruthless gathering has exterminated it, might be followed, it seems to me, with other plants, in private and public lands. Nature deserves assistance of this sort and the planting of native species, which undoubtedly once grew in this region, as records show, would help her to reestablish the original variety of our flora. The wild flowers that give me the finest thrill are our native orchids, and I miss particularly the purple fringed orchids, which must have been once part of our flora but are now extremely rare within fifty miles of New York. There are remote swamps in the Harriman Park where they would be at home, and the plans for reforesting the Ramapo section, which was sadly scarred by a great fire twenty years ago, might include restoration of rare herbaceous plants as well.

Little by little, we may hope to educate to better manners those who rip off branches of flowering dogwood and mountain laurel and bear them home wilted or throw them away when half way back to the city. I believe that ideas of conservation do increase, and that sustained effort on the part of all of us who wish to preserve our native flora is gradually having its desired effect. For a while, however, those who thus ravage the roadside shrubs and flowers will bring on their own punishment in destroying everything within a few rods of the motor highways. When the early spring flowers are gone from the reach of the average motorist, they may realize what they have done. For the walker, who ventures afar off the roads and into the forests, the hidden treasures of Nature will be disclosed, there awaiting the time when it may be safe for them to venture back and retake their old stands. I believe there are enough safe strongholds for native species to

sustain their existence, until education in conservation has progressed to a degree where they may expand their territory. The adoption of laws in several states, for the protection of threatened species, the increase in public sentiment for plant conservation, and the yearly turning out of our schools and summer camps of young people who have been taught to spare the flowers, all help gradually to establish a more enlightened understanding of the place of our wild flowers in contributing to our esthetic and spiritual satisfaction. Conservationists will need to be watchful for a long time to come, but Nature has her hidden sanctuaries and, if we give her a chance, the plants which have been most harried for their beauty will come back where more of us can see and enjoy them.

RAYMOND H. TORREY.

FOSSIL WALNUTS AND LIGNITE FROM PORTO RICO

(WITH ONE TEXT-FIGURE)

During the year 1924 The New York Botanical Garden received from Señor Adriano Gonzales, of Arecibo, Porto Rico, a number of walnuts that were recorded as having been found at a depth of sixty feet below the surface, in an excavation made in connection with a dam under construction on the Guajataca River, near Isabela, in the vicinity of Quebradillas, in the north coast region of Porto Rico.[1] Associated with them was considerable woody débris logs and branches—specimens of which were transmitted with the walnuts. Recently all of this material was submitted to me for critical examination and comparison with material of like characters represented by specimens of the existing flora.

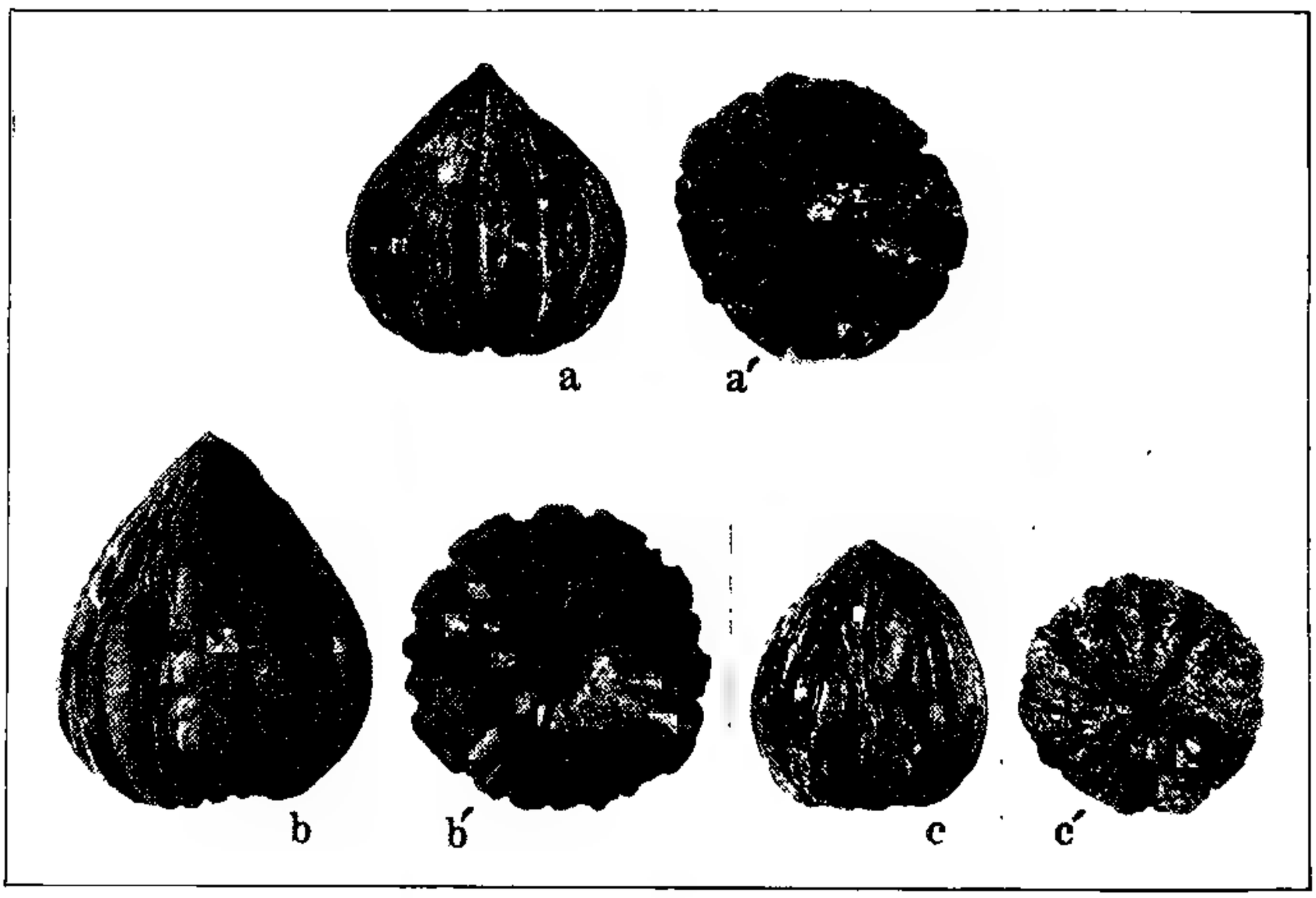
The walnuts are very satisfactory subjects for study. Although no fragment of an exocarp has been preserved, the specimens are otherwise in perfect condition, and they may be seen to represent

[1] For a general description of the work mentioned see article entitled "Servicio de Riego de la Costa Norte" (R. A. Gonzales, chief engineer), in Revista de Obras Publicas de Puerto Rico, Año 2, Num. 16, pp. 473–480. April, 1925.

a species that is evidently closely related to, or possibly identical with, one or the other of the two existing species of the West Indies—*Juglans jamaicensis* De Candolle and *J. insularis* Grisebach; but in view of the conditions under which they were found I have deemed it advisable to figure two of our specimens and to describe them as representing a new, extinct species, under the name

Juglans archaeoantillana n. sp.

Fruit consisting of ovoid-conical nuts, about 2.5 centimeters in length by 2.75 centimeters in maximum width, with thick, hard endocarp that is deeply and irregularly sculptured from base to apex with furrows and rounded ridges. (Figs. 1a, 1a′.)



FIGURES 1a, 1a′ = *Juglans archaeoantillana* n. sp., natural size. Specimens in paleobotanical collections, New York Bot. Gard., lot No. 34.

FIGURES 1b, 1b′ = *Juglans jamaicensis* De Candolle, natural size (introduced for comparison). Porto Rico, vicinity of Utuado near Adjuntas, *Bartolome Barselo,* Mar., 1915. Specimens in Herb. New York Bot. Gard., No. 4960.

FIGURES 1c, 1c′ = *Juglans insularis* Grisebach, natural size (introduced for comparison). Cuba, Province of Santa Clara, *J. A. Shafer,* Feb. 28, 1912. Specimens in Herb. New York Bot. Gard., No. 12261.

(Photographs by courtesy of the American Museum of Natural History.)

All of the specimens are blackish in color and lignitic in texture, and in each one the 2-valvate character is more or less conspicuously exemplified, probably from shrinkage due to desiccation on exposure to the air, following a long period of entombment in the earth; and for the same reason it may be inferred that the original size of the nuts may have been somewhat larger than now obtains.

Comparison of all the specimens of the fossil species with an average lot of nuts of each of the existing ones indicates that the fossils are intermediate in size between that of each of the existing species, and that the sculpturing does not show any distinguishing features in either of the three species. For purposes of comparison I have figured two specimens of *J. jamaicensis* (Figs. 1b, 1b′) and two of *J. insularis* (Figs. 1c, 1c′). It should be remarked, however, that individual specimens of each of the three species might be selected which would be exceedingly difficult to differentiate, satisfactorily, one from another.

The geographical distribution of the two existing species is of interest, especially when considered in connection with the fossils. *Juglans jamaicensis* is an element in the native flora of Porto Rico and of Hispaniola, and is not recorded from elsewhere.[2] *Juglans insularis* is, as far as recorded, confined to Cuba. If the immediate ancestral relationship of either of these species could be definitely traced to *Juglans archaeoantillana* it might represent an important factor in the determination of former geological conditions and recent topographic changes in the region.

The wood associated with the nuts is mostly in the form of lignite. It shows no indication of decay, and the harder pieces take a high polish. The structure is well preserved but, thus far, all efforts to determine the generic or even the family relationship of any of it have failed.[3] Beyond the fact that the wood was

[2] *Note.* The specific appellation, *jamaicensis,* is a misnomer and is misleading, as the species is not known to occur in Jamaica. The type specimen is now known to have been erroneously credited to that island.

[3] I am indebted to Professor Samuel J. Record, of the School of Forestry, Yale University, and to Mr. Arthur Koehler, of the Forest Service, U. S. Department of Agriculture, for examinations of and reports on specimens submitted.

identified as that of a dicotyledonous angiosperm its identification remains undetermined.

In order, if possible, to obtain light upon the stratigraphic relations of the deposit in which the plant remains were found all available information was transmitted to Dr. Bela Hubbard, to whom we are indebted for the exploration and a detailed investigation of the geology of the region,[4] previously covered in a reconnoissance by Dr. C. P. Berkey.[5] In answer to my communication Doctor Hubbard kindly responded, under date of September 2, 1925, as follows:

" Dear Dr. Hollick:

Yours of August 17th received and beg to advise as follows:

1. The geologic map accompanying my report on the Lares District shows the area around Quebradillas as lying on Quebradillas limestone [U. Oligocene or Miocene].

2. Over much of the area bordering the coast the Tertiary formations are covered by Pleistocene or Recent deposits. These are:

(a) San Juan formation (= consolidated beach and dune sands).

(b) Unconsolidated Playa deposits, chiefly at mouths of rivers.

(c) 'Caliche' or secondary limestone, formed at the surface by ground water.

3. The limestone referred to in your letter as occurring on the Guajataca River near Quebradillas [overlying the deposit containing the walnuts] is probably 'caliche,' and if so cannot be older than the date of uplift of the coastal plain (early Pliocene); but more likely much younger (Pleistocene or Recent).

4. Such deposits of 'caliche' are particularly common in

(a) Caverns,

(b) River gorges,

where they have been found to be quite thick. They contain a matrix of fragments of the adjacent Tertiary limestone, the whole being well cemented in many localities. Owing to the presence of Tertiary fossils in these angular limestone fragments in the 'caliche' it is sometimes difficult to distinguish this rock from the adjacent Tertiary limestone itself, especially if the latter has been badly weathered.

[4] The geology of the Lares District, Porto Rico. Bela Hubbard. Scientific survey of Porto Rico and the Virgin Islands, vol, 2, pt. 1, text figs. 1–42, tables 8, map 1, New York Acad. Sci., 1923.

[5] Geological reconnoissance of Porto Rico. Charles P. Berkey. New York Acad. Sci., Annals, vol. 26, pp. 1–70, pls. 1–3, text figs. 1–20, March 3, 1915.

5. From your description of the clay and fossils found beneath this limestone on the Guajataca River I would not hesitate to assume that the latter is ' caliche.'

Trusting this explanation may answer your questions, I am,

Very sincerely yours,

[signed] B. HUBBARD."

From the above communication it may be understood that the walnuts and other plant remains associated with them are, apparently, of recent geologic age, as they were found in a deposit that overlies the mid-Tertiary Quebradillas limestone, and may be assumed to lie immediately beneath the " caliche " rock, which is regarded as certainly no older, and probably as considerably younger than Pliocene. In all probability the deposit represents one of the several well-defined periods of Post-Pliocene coastal-plain depression, and its present position one of subsequent elevation.

ARTHUR HOLLICK.

IMMUNIZATION AGAINST DISEASES PRODUCED BY MICROSCOPICAL PLANTS[1]

The lecturer exhibited slides illustrating the bacteria of typhoid, diphtheria, and scarlet-fever, and explained their methods of propagation and growth. He displayed a photograph of a vessel containing bouillon in which diphtheria germs had been planted and which had multiplied until they formed a superficial crust, just as the plants forming mould would do on the surface of a mouldy substance. These phenomena were discussed as follows:

If one of these germs is deposited in a suitable medium for its growth, it reproduces itself and forms a colony of characteristic appearance for the different species. If it be planted in the tissues of an animal susceptible to it, it produces similar growths, and, in addition, it gives him a disease that possesses characteristic symptoms. If plants from this animal are transplanted to another, he undergoes the same experiences and presents the same symptoms. If the plants are grown in bouillon until they form a large mass, as in the jar that was shown, the same result will occur, but if a

[1] Abstract of lecture delivered at The New York Botanical Garden on Saturday afternoon, July 10, 1926.

portion of the bouillon is separated and every germ in it is removed, which can be done by suitable filters or in other ways, and this sterilized liquid be introduced into the animal, he will suffer the same disease, but none of the plants will be in his body and he cannot impart the disease to another, proving that the disease-producing agent is not the germ itself but some chemical substance that it produces. This is analogous with larger plants that grow about us. The belladonna plant produces atropin; the foxglove, digitoxin; the nux vomica plant, strychnine. We can extract these toxins and kill an animal promptly by administering them. Human beings are careful to avoid those dangerous plants, and can thus escape being poisoned, but when the diphtheria or typhoid plant is growing in one's system, there is no place where its toxin can escape, except into our own body, and it then poisons us the same as though it had come from the outside. When the living germs get into the body, they propagate without limit and their poison accumulates, but when the pure toxin is introduced it cannot increase, and the person recovers if the amount is not too large.

These facts furnish the explanation for what follows: A man in the prime of life, of perfect physique and in perfect health is suddenly stricken with typhoid. In a very short time he is brought low, is helpless as an infant and his life despaired of. Examination shows relatively few germs in his system, and these can have produced very little toxin. But as the days go by, the germs come to exist in myriads and a quantity of poison accumulates. As the germs and the poison thus thrive, the patient becomes progressively weaker, yet, when he is at his lowest ebb, he overcomes this disease at its strongest, and recovery sets in. The story of the investigation and discovery of this anomaly is a very long one. It is enough to say here that there have been discovered organs in the animal body, especially the human body, which exist for the production of antidotes to the poisons made by these disease germs and which are thus known as antitoxins. In some individuals they appear to exist originally, so that these persons cannot acquire that particular disease. That person is then said to be immune against that disease. In others, there is partial immunity, varying in degree. Those who are not immune may be made so in various ways. The usual method is by contracting the disease

and recovering from it, after which they are immune against another attack. This process, or any other by which the same result is accomplished, is called immunization.

It was quite natural that as soon as the above facts came to be understood, efforts should be made to discover harmless and efficient methods of immunization, and I may say at once that success beyond any expectation has been achieved. We have learned that even when the attack of disease has already been sustained, prompt immunization can protect against its worst progress. This treatment has come to be known as curative rather than preventive, but its nature is that of immunization.

The method of immunization first employed in medicine was nature's own, that of inoculating the patient with a mild form of the disease, with the expectation that he would recover and thereafter be immune against perhaps severer forms. The method was efficient but dangerous in various ways. A disease previously mild might, after inoculation, prove very severe or even fatal. Furthermore, it might spread to others from the inoculated person. The virus might be impure and objectionable germs might be included in it. This virus was at first taken from one human for use on another. Later it was found that it might be taken from some other animal than man. This process, which has by now been greatly perfected and freed from practically all of its dangerous and objectionable features, is known as vaccination. It is to be remembered that its essential feature is the introduction of the living germ; that its reaction is that of causing the subject's own body to manufacture the antitoxin; that this may not be done quickly enough to save the patient's life, and that the disease is thus capable of transmission to others. A great advance was made when it was found possible to kill the germs and then inject them with their contained toxin. This toxin then started the antitoxin manufacturing, and immunization was effected by developing the patient's own powers of resistance, a great desideratum in the process.

A new departure was made when it was found possible to extract the antitoxin from an immune body and introduce it to the body of another for preventive or curative purposes. This antitoxic treatment possesses the advantage of being prompt and certain, as any amount can be introduced that is necessary to destroy

the toxin. Also, it is impossible, by this method, to transmit the disease. It is open to the objection that we are getting the body of some other animal to produce the curative substance, and thus depriving our own body of the development of its own powers of resistance. This fact has actually been urged against the general employment of the method, lest the general resisting powers of the human race should be impaired.

Without going into these details, it is interesting and instructive to note the results of the use of these various methods of treatment. Evidence of their efficiency is altogether conclusive, whether we consult statistics or the general facts that come within our personal experience and observation. Everyone with a fair degree of general information and reasonable judgment knows that if small-pox contagion existed to-day as it did during the childhood of the oldest people now living, our present intercourse between cities by freight, express, post, and passenger travel would be utterly impossible. There would be a state of continuous and universal quarantine, and, even then, we should be unable to prevent periodic decimations of the population. Pock-marked faces would be as common as bobbed heads and bare legs, and not half so pretty. It is equally well known that the terrible scavengers of childhood, diphtheria and scarlet-fever, no longer terrify as previously. Gross ignorance, deep stupidity, perversity, and vanity are the only influences that to-day stand opposed to the general acceptance of modern immunization procedures. Even these are making but a feeble, and progressively more feeble resistance to the practical or actual extermination of some of our most fatal diseases.

A graph that was shown indicates that in Prussia, before the law of 1874, compelling vaccination, the annual death rate from small-pox was about 87 per hundred thousand of the population. The very next year it fell to about 9 per hundred thousand, and in the following years became so small as scarcely to be capable of indication upon the chart. In Austria, where there was no such law, it continued to range between 40 and 95 in those same years.

Statistics regarding diphtheria are about as startling. In New York City the death rate has been reduced more than a third since 1920, although it was then but a small fraction of what it was a

quarter of a century before. In Detroit, the death rate was reduced nearly three-fourths in three years, and there have been much greater reductions in many other cities. In the United States Army, typhoid fever has become almost exterminated. Perhaps the most astonishing results of all have been in the preventive and curative treatment of scarlet fever. Many cases have been reported in which the child, before the remedy was administered, has become unconscious, dark in the face, and breathing as is usual just before death, and has been playing and calling for food within a few hours afterward.

In conclusion, I will refer to the greatest advance of all in this defensive struggle: the various tests, the Schick and Dick tests being best known, by which we can determine whether the patient is immune to the disease or whether he would probably contract it if exposed. In this way, we avoid the necessity of applying the preventive treatment to all alike. We have at least one case in which the children of an entire school underwent the test and treatment, where indicated, with the exception of two whose parents would not consent. Later, these two contracted the disease and died. The feelings of these parents are easily imagined, but what are those of the self-appointed advisors who dissuaded them from taking steps to protect their offspring? My object here to-day is not to entertain; not even merely to instruct; but to save life and the lives chiefly of little ones who cannot help themselves. It is my duty to plead with you to go to any necessary amount of trouble to inform yourselves; to consider the facts impartially; to avoid vain and reckless ignoramuses or selfish charlatans who would sacrifice any number of lives so long as they could enjoy a fleeting gratification of their vanity. When you have satisfied yourselves, become missionaries in this field of saving life. Everyone flocks to assist an unfortunate sufferer after his accident. How much better to join the army of those who are seeking to prevent by increasing the general information regarding the elimination of disease.

H. H. Rusby, M.D.

REEF-BUILDING AND LAND-FORMING PLANTS[1]

That certain water-inhabiting lime-secreting animals, the corals, have been and still are active agents in building reefs and eventually in forming land, has been a matter of common knowledge and belief for about eighty years, but that certain water-inhabiting lime-secreting plants, known to botanists as the algae, play an important part in the same great work, a part often more important than that of the corals, has received no particular emphasis until within the last twenty years. An impetus towards awarding a greater share of credit to the plants in this line of activity was given in 1904 by the publication of the report of the Coral Reef Committee of the Royal Society of London on "The Atoll of Funafuti." This atoll in the South Seas was selected for investigation because it was believed to be a true or typical coral reef. Borings were made there, one of them to the depth of more than 1,100 feet. The cores brought up were examined microscopically and otherwise, and as a result of this investigation lime-secreting algae or seaweeds were found to be the chief builders of this atoll. In other words, Funafuti was found to be "a true coral island" that was scarcely coral at all. It was built up chiefly by hard stone-like plants instead of the hard stone-like skeletons of coral animals.

Most people think of sea plants, if they think of them at all, as small delicate ornamental "sea-mosses" or as coarse succulent, not especially attractive, kelps and rock-weeds, having, in either case, little solid substance to be left behind on their decay. The fact is, however, that there are many different kinds of marine plants that secrete lime from the sea-water and become hard and stone-like, so that their decay or their continued upward growth is accompanied by a considerable increase in the height of the sea-bottom wherever these plants happen to be growing. The corals are, generally speaking, confined to the warmer seas, but the corallines, lime-secreting marine plants with a superficial resemblance to the corals, are much more widely distributed, having, in fact, been found to be very abundant more than twelve degrees

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, August 14, 1926.

north of the Arctic Circle. The late Professor Kjellman, of Upsala, has stated that off the shores of Spitzbergen and Nova Zembla, a certain species of coral-like alga forms thick layers on the ocean floor, mostly in 60 to 120 feet of water and that "in the formation of the future strata of the earth's crust in these regions it must become of essential importance."

Dr. Henry B. Bigelow, of Harvard University, was quoted as to the great importance of the lime-secreting plants in building up the Challenger Bank off the shores of Bermuda and also in contributing to the composition of the so-called " shell sands " of the Bermuda shore. Dr. J. Stanley Gardiner has emphasized the great abundance of calcareous algae on the Chagos reefs in the Indian Ocean and he states that "were it not for the abundance and large masses of these organisms, there would be no atolls with surface reefs in the Chagos." Dr. A. Weber-van Bosse, of Amsterdam, has described extensive reefs of coralline algae in seas of the Dutch East Indies.

There are also fresh-water algae, relatives of the seaweeds, that secrete lime and build rock or a calcareous tufa. These seem to have been more abundant in past geological ages than at present. Dr. C. D. Walcott, the distinguished Secretary of the Smithsonian Institution in Washington, has directed attention to the existence of great reefs of limestone of the very ancient Pre-Cambrian Age in the Rocky Mountain region. Many of these deposits show organic remains and Dr. Walcott attributes the origin of these limestones largely to the action of lime-secreting algae and bacteria. Dr. G. R. Wieland, of Yale University, impressed by the abundance of algal or supposed algal remains in the older Paleozoic strata, has referred to the Pre-Cambrian, Cambrian, and Ordovician ages as characterized by the " Reign of Algae," and he has expressed the opinion that " no dominant organisms of later ages, whether plant or animal, ever exceeded the Paleozoic seaweeds as rock-forming agents or left a bulkier record." Altogether, there is an increasing accumulation of evidence that lime-secreting plants are not only at the present time locally more important than the corals in reef-building and land-forming, but also that this was true to an even greater degree in past geological ages.

The lecture was illustrated by nearly one hundred lantern-slides, showing lime-secreting algae, both living and fossil, from various parts of the world, and reefs or other deposits made by their activity.

MARSHALL A. HOWE.

FOURTH GRANT FROM THE INCOME OF THE CHARLES BUDD ROBINSON FUND

This fund commemorates Dr. Charles Budd Robinson, an assistant curator at The New York Botanical Garden, 1906–1907, who was killed by fanatics in 1913 on the island Amboina of the Dutch East Indies, while in the employment of the Philippine Islands Bureau of Science. It was established in 1914, through subscriptions of his friends; the principal is $755.04, yielding about $35 income annually, specified for aiding botanical exploration. Grants for this purpose have been made as follows:

1. $50, in 1918, to Mr. E. D. Merrill, then Botanist of the Philippine Islands Bureau of Science, to aid botanical exploration of the island Guam, by Mr. Peter Nelson.

2. $75, in 1922, to Rev. Dr. Herbert M. Denslow, Honorary Custodian of the Local Herbarium, to aid him in collecting specimens in southern New York.

3. $100, in 1924, to Mrs. Agnes Chase, Assistant Agrostologist, United States Department of Agriculture, for aid in her trip to Brazil, for the study and collecting of grasses. (Jour. N. Y. Bot. Gard. **26**: 196–198. S 1925.)

4. $100, now granted to Professor E. D. Merrill, of the University of California, to aid in botanical field work in Indo-China, carried on by Dr. Petelot, with the especial attempt to obtain specimens of little-known species described by the botanist Louriero in 1790.

N. L. BRITTON.

THE BIRCH LEAF-MINER

For several seasons past the white birches have been more or less disfigured by the presence of numerous dead leaves. Close inspection shows this injury to be due to a "leaf-miner" which works within the leaf, causing its death. A specimen was recently

submitted to Dr. E. P. Felt, State Entomologist, and from him we have obtained the following statement which may be of interest to the readers of the JOURNAL.

"The Birch Leaf-Miner was first found in this country in 1923 and since then has become generally distributed over eastern New York and southern New England at least. It occurs throughout Long Island and is somewhat common and occasionally is rather injurious to birches in the vicinity of New York City. The work of this insect is confined as you may have noticed to the more tender leaves and, although birches are somewhat disfigured, I have not considered the work of the insect as particularly injurious. The parent of the miner is a small blackish sawfly about 1/8 of an inch long. It occurs in some places in immense numbers, the adults issuing in early spring and distributing their eggs within the leaves. I have seen hundreds of acres of birch with a distinctly brown appearance as a result of this insect's work. The false caterpillars mine the leaves, and in the case of ornamental birches, it is very probable that early spraying with a tobacco-soap preparation or similar contact insecticide would destroy the miners before they caused appreciable injury. One should watch for the general occurrence of small mines in early spring and spray as indicated above, if the leaves are to be kept in good condition."

FRED J. SEAVER.

NOTES, NEWS, AND COMMENT

A plant of the famous Queen's Flower, *Lagerstroemia speciosa* [*Flos-reginae*], has been given to our collection from the Florida garden of Dr. G. W. Tyrell, of Perth Amboy, N. J.

The Japanese Flowering Dogwoods in the Fruticetum were covered for one month with the largest and most perfect blooms in a decade. These trees, now some twenty-five years old, promise to be very showy this autumn with bright red fruits.

Dr. Orland E. White, Curator of Plant Breeding and Economic Plants at the Brooklyn Botanic Garden, gave an illustrated lecture on Saturday afternoon, September 11, 1926, at The New York Botanical Garden on "Bolivian Trails." Dr. White was associated with the Mulford Biological Exploration of the Ama-

zon Basin Expedition in 1921 1922, his work being chiefly concerned with orchid and economic plant collecting. He discovered a new geographical source for *caapi* or *ayahuasco* and the botanical source of several other drugs. The lecture was descriptive of the plants of the Bolivian temperate highlands and the tropic lowlands, as they relate to the lives of the natives (chiefly Indians) inhabiting these regions. Descriptive aspects of the tropical wilderness lowlands and the densely populated temperate highlands were contrasted. About one hundred colored lantern slides illustrating the plants native to these regions, the various aspects of the scenery, and the native life and customs, were used. Among them were scenes showing the preparation of tapioca, collecting wild rubber and Brazil nuts, picking coca leaves, the use of certain tree barks as clothing, and the importance of the balsa tree as raft material on the rivers of interior tropical Bolivia. Pictures of the fruit and flowers of the arnotto tree from which the common yellow dye for coloring butter and cheese comes were also shown.

The lecture of August 21 at The New York Botanical Garden, entitled "Among Sea-bird Cities of the Atlantic" was delivered by Mr. S. Harmsted Chubb, associate curator at the American Museum of Natural History. Mr. and Mrs. Chubb have spent a number of vacation seasons in the study of island fauna along the Atlantic coast as far north as the bird colonies about Perce, studying and photographing not only the birds, wild flowers, and scenery of the regions visited but also finding much of interest in the people and their industries. The lecturer described the life and habits of large colonies of herring-gulls, terns, and other sea-birds on islands well off our coast, as well as a colony of approximately 15,000 gannets and other species, nesting on the ledges of Bonaventure Island, Canada, in the Gulf of St. Lawrence. Just back of the gannet ledges in the wild grassy places were shown acres of northern Iris and in the coniferous woods many species of northern wild flowers. The activities of the fisherfolk on some of the islands gave a touch of human interest, as they were preparing to cure a catch of 33,000 pounds of pollock, or making the daily haul of lobster traps. About one hundred colored slides made from photographs by the lecturer were used as illustrations,

including those showing the cliffs of Bonaventure Island literally covered with snow-white gannets guarding their young, and among the flowers a rare variety of wood oxalis.

Miss Ada Sterling, formerly of the editorial staff of Messrs. Harper Bros. and author of "Memoirs of Mrs. Clay, of Alabama"; "Mary, Queen of Scots"; "The Jew and Civilization," etc., and known to a wide New York circle through her popular lectures, was the lecturer at The New York Botanical Garden on Saturday afternoon, July 24, her subject being "The Oil Olive: Tree and Fruit." Miss Sterling opened her lecture with a historical survey of the oil olive, locating it in the "Garden of Eden," among the food trees provided for man, and, passing through Palestine and Syria, Italy, Spain, and other olive-growing centers along the Mediterranean Basin, described the increasing recognition of the food and commercial values of the olive in the present day. The lecturer pointed out the symbolism of the olive, called "the fruit of peace"; its curious plant-relations; the need for free use of olive oil and olives themselves by military and marine groups, and, coming down to the introduction of this fruit into what is now a part of the United States by the Mission fathers of Mexico, in 1759, enlarged upon its culture in California, and the rapid development of the olive industry since the discovery, twenty years ago, of "the ripe olive." The lecture was illustrated by about forty colored and plain slides, many of which were made especially for this occasion by the photographer of the Department of Agriculture; others being loaned by the California Olive Association, and others, showing olive groves of Palestine, France, and Italy, coming from foreign sources.

Dr. Clara Barrus, known in medical circles as a psychiatrist, and in literary circles as the author of several books, and chiefly as the biographer of Burroughs, lectured at The New York Botanical Garden, Saturday afternoon, June 26, on "Our Friend John Burroughs." The lecturer was associated with Burroughs during the last twenty years of his life. For several years he and Mrs. Burroughs lived in her home. Last year saw the completion of the two-volume "Life and Letters of John Burroughs" upon which Dr. Barrus had worked some fifteen years. Dr. Barrus's

interpretation of the well-loved literary naturalist is based on both a wide knowledge of her subject and a sympathetic understanding. She makes Burroughs live before the hearer, no less through graphic description and telling anecdote, than by some ninety or more beautiful colored slides which picture Burroughs from the roots up. His life unfolds before the audience, from the crude little blue cradle in which he was rocked, to the humble grave in the hillside pasture on that Catskill farm where he was born. We see him as he leaves the little red school house near home; later in Washington, the chum of Walt Whitman, during the Civil War. We learn of his struggles and achievements; in time see him at Yale University, receiving an honorary degree in recognition of the books which have had such a widespread influence upon our national life. We learn what an all-round man he was, a conscientious school teacher, a painstaking government clerk, and efficient bank examiner, a successful fruit farmer. He was a lover of seclusion, yet a jolly good "mixer." We glimpse him in his vineyards at Riverby; at his writing table in the quiet of Slabsides; entertaining "pilgrims" at Woodchuck Lodge; see him cooking, gardening, swimming, loafing; camping in Yosemite Valley with John Muir, in the Yellowstone with Roosevelt, and in the Great Smoky Mountains with Edison, Ford, and Firestone. And always, in season and out of season, we see the delightful essayist to be an eager student and a faithful interpreter of Nature.

Among the foreign delegates to the International Conference on Flower and Fruit Sterility and the International Congress of Plant Sciences, who registered in the library, were the following: Mr. Wm. Nowell, Port of Spain, Trinidad; Mr. T. A. Sprague, Kew, England; Fraulein Anni Breuer, Germany; Prof. Dr. Georg Tischler, Kiel, Germany; Prof. Dr. R. Wettstein, Vienna, Austria; Dr. John Briquet, Geneva, Switzerland; Dr. M. J. Sirks, Wageningen, Holland, and Dr. F. A. F. C. Went, Utrecht, Holland; Dr. C. H. Ostenfeld, Copenhagen, Denmark; Dr. Rudolf Florin and Mr. Otto Heilborn, Stockholm, Sweden; Dr. Nils E. Svedelius, Upsala, Sweden; Nicolas and Tatiana Maximow, Leningrad, Russia; Prof. Dr. B. Nêmec and Prof. Dr. K. Domin, Prague, Czechoslovakia; Dr. Feliks Kotowski, Warsaw, Poland;

Prof. Dr. Al. Borza, Cluj, Roumania; Prof. Teikichi Fukushi, Tottori, Japan; Prof. Takamichi Takahashi, Tsu-City, Japan; Prof. Keita Shibata and Mr. Goro Ida, Tokyo, Japan, and Dr. Eileen R. L. Reid, Perth, Western Australia.

Other summer visitors were Prof. H. H. Whetzel, Ithaca, N. Y.; Prof. Norman Grier and class, Cold Spring Harbor, N. Y.; Prof. L. O. Overholts, State College, Pa.; Dr. J. B. S. Norton, College Park, Md.; Dr. Edgar T. Wherry, Mr. W. Stuart, and Mr. E. P. Killip, Washington, D. C.; Miss Laura M. Bragg, Charleston, S. C.; Prof. A. C. Moore, Columbia, S. C.; Dr. C. D. Sherbakoff, Knoxville, Tenn.; Dr. C. H. Farr, St. Louis, Mo.; Dr. Hilary S. Jurica, Lisle, Ill.; Prof. L. A. Kenoyer and class, Kalamazoo, Mich.; Prof. Edwin B. Payson, Laramie, Wyo.; Prof. E. D. Merrill, Berkeley, Calif.; Prof. L. R. Abrams, Stanford University, Calif.; Mr. Rimo Bacigalupi, Mills College, Calif.; Prof. F. E. Lloyd, Montreal, Can.; Mr. C. H. Ballou, Havana, Cuba; Mr. Rafael A. Toro and Dr. and Mrs. John S. Dexter, Rio Piedras, P. R.; Mr. Lawrence Ogilvie, Bermuda; Prof. Takashi Sugawara, Tokyo, Japan, and Señores Juan de G. Rodriguez and Isidoro R. Collado, Philippine Islands.

Meteorology for September. The total rainfall at The New York Botanical Garden for the month was 4.13 inches. The maximum temperatures for each full week of the month were 84° on the 8th, 82° on the 19th, and *91° on the 25th.* The minimum temperatures were 51° during the night preceding the 12th, and *45°* on each of the nights preceding the *15th and the 27th.*

ACCESSIONS

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
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Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

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N. L. BRITTON

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ENGLISH GARDENS
MONTAGUE FREE

SMALL GARDEN COMPETITION, 1927

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ACCESSIONS

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JOURNAL
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THE ROYAL BOTANIC GARDENS AT KEW, ENGLAND[1]

The Royal Botanic Gardens, Kew, cover nearly 300 acres. A large portion of this area is devoted to the trees and shrubs which are hardy at Kew, arranged according to their natural families.

The herbaceous and annual plants are also arranged systematically in formal beds, where they can easily be examined by students, while a certain amount of space is devoted to ornamental and decorative plants arranged for effect.

There is a large Rock Garden, a garden of medicinal plants and a good collection of aquatics. In the Greenhouses an attempt is made to grow a representative collection of plants of economic and scientific interest as well as those of ornamental value from all parts of the tropics and subtropics.

In addition to the Gardens proper, there are four Museums in which the economic products derived from plants are displayed, a Laboratory and the Herbarium and Library. The Herbarium contains some 4,000,000 dried specimens of plants, representing the flora of the world, and the Library comprises some 40,000 volumes of botanical books.

Kew also possesses a fine collection of botanical pictures painted by Miss Marianne North in various parts of the world, and a large collection of plant drawings which are freely used for reference. In the Jodrell Laboratory research work in plant morphology and physiology is carried out.

The Gardens became a national institution in the year 1841 when Sir William Hooker was appointed Director. He was suc-

[1] Abstract of an illustrated lecture given at the Museum of The New York Botanical Garden on Saturday afternoon, October 2.

ceeded by his son, Sir Joseph Hooker, who was followed by Sir William Thiselton-Dyer, who was succeeded by Sir David Prain, formerly Superintendent of the Royal Botanic Gardens, Calcutta.

The present Director, Dr. Arthur W. Hill, was appointed to the post in 1922.

In order to appreciate the connection between the Royal Botanic Gardens, Kew, and the British Empire, it is necessary to look back to the past history of the institution. Kew was founded by Princess Augusta of Saxe-Gotha in 1760 as a private botanic garden and on her death, George III, who succeeded to the property, appointed Sir Joseph Banks as his botanical adviser. Sir Joseph Banks, with the encouragement of the king, considerably developed the gardens and started the practice of sending collectors to the colonies and other parts of the world, and so commenced the relationship of Kew with all parts of the empire, which has ever since been maintained. One of the early attempts to introduce economic plants of importance was that of Captain Bligh, whose first effort to introduce the Bread Fruit to the West Indies ended so disastrously in the mutiny of the Bounty. Among other economic plants which became known in connection with these Kew expeditions may be mentioned the genus *Eucalyptus,* the genus *Araucaria,* the Redwood Tree of California, *Sequoia sempervirens,* and many plants of horticultural interest from South Africa and other parts of the world, which are now common garden plants.

Later developments of this economic side of the Kew work, which have resulted in enterprises of far-reaching importance, are the introduction of Cinchona from South America to India, Pará Rubber from South America to Ceylon and the Federated Malay States, Tea, Coffee and Cinchona to Jamaica, Cocoa to the Gold Coast, and many others.

The value of Kew to botanical enterprises throughout the empire is also well shown by the collection of economic plant products in the Museums and by the specimens preserved in the Herbarium. With the aid of these large collections it is possible to supply information to correspondents overseas on practically every specimen of importance that they may submit for identification.

The work of the Herbarium is of particular importance to botanical work throughout the empire, as not only is the vegetation of our colonies very fully represented, but also the floras of our different overseas possessions have there been mainly compiled. Among these floras may be mentioned the Flora Capensis, the Flora of Tropical Africa, the Flora of Australia, the Flora of British India, and a new Flora of West Africa, now in course of preparation.

The Kew Bulletin also provides information on botanical and economic questions relating to all parts of the empire.

Another important side of Kew is the connection which it has always maintained with the daughter botanic gardens in the colonies and dominions. Many of these owe their existence in the first place to suggestions made by Kew, since the Director of Kew is also Botanical Adviser to the Secretary of State for the Colonies, and, from Kew, men have been sent out from early times in her history to take charge of these overseas gardens. Most of the men who are now filling these posts were formerly at Kew as student-gardeners and among these may now be found Directors of Agriculture and Superintendents of Botanic Gardens in various parts of the world. There are some 47 of these student-gardeners at Kew at the present day and every year two or three are selected to fill posts in connection with botanic garden or agricultural station work in the colonies. This important side of Kew work is a direct outcome of the policy initiated over a century ago by Sir Joseph Banks, when men trained at Kew were sent to take charge of the botanic gardens in Ceylon, St. Vincent, and Trinidad, which were created at that time.

Kew not only performs an educational function in the training of men, but also affords valuable educational facilities to many thousands of visitors during the year. Large parties of students and scholars also come to Kew to pursue their botanical studies, especially from the schools around London.

ARTHUR W. HILL.

A VISIT FROM DR. ARTHUR W. HILL

Dr. Arthur W. Hill, the Director of the Royal Botanic Gardens at Kew, England, was the guest of Dr. N. L. Britton, Director-

in-Chief of The New York Botanical Garden, on September 30 and October 1 and 2. On September 30 he visited the Boyce Thompson Institute for Plant Research at Yonkers and on October 1 the Brooklyn Botanic Garden. On Saturday afternoon, October 2, he delivered in the Museum of The New York Botanical Garden an illustrated lecture on "The Royal Botanic Gardens at Kew, England," an abstract of which appears in the present number of the JOURNAL. Following this lecture, Dr. Hill and botanists from New York City and vicinity were the guests of Doctor Britton at a dinner at Sormani's Restaurant on Pelham Parkway and Boston Road. The dinner party numbered forty-five men, representing Columbia University, the Boyce Thompson Institute, Brooklyn Botanic Garden, Yale University, Cornell University, Princeton University, Rutgers University, Pennsylvania State College, the Bureau of Plant Industry, and The New York Botanical Garden. After the dinner, Dr. Britton read the following address of welcome:

"We gladly welcome the occasion of a visit by the Director of the Royal Botanic Gardens at Kew, as opportunity to express to him our cordial appreciation of the great contributions to knowledge which have characterized that wonderful institution throughout its history. These have aided and stimulated botanical investigation in all lands, and nowhere more than in these United States, portions of which Dr. Hill has been traversing during the past few weeks. He and his distinguished predecessors have had the guidance and direction of the activities of Kew over a period of 86 years, the institution dating as a public botanical garden from about the year 1840, its site, however, occupied by royal gardens for a century preceding.

"My first visit to Kew was in 1880, in the course of a trip to Europe soon after graduation; this was during the administration of Sir Joseph Hooker. My first studies there were in 1888, on which occasion I spent much time in determining Bolivian specimens collected by Dr. Rusby; Sir William Thistleton-Dyer was Director at that time. It was on this visit that the inspiration for the establishment of a botanical garden in New York was obtained by Mrs. Britton, which bore fruit a few years subsequently through a committee of the Torrey Botanical Club. We were at Kew again in 1891, for supplementary inspiration, and for study of the Paraguay collection made by Dr. Morong. I was at Kew for a week after the Paris Botanical Congress in 1900; again in 1902, soon after our first West Indian explora-

tions had been accomplished; again in 1905, after the Vienna Botanical Congress. In the summer of 1911 we were there for the study of Cuban and other West Indian plants; Sir David Prain had then been appointed Director. Our most recent visit to Kew was in 1920, especially for the study of Cacti, and of some of the large collections from northern South America, then commencing to be obtained; the institution was still under the directorship of Sir David Prain, but Doctor Arthur W. Hill was Assistant Director, since promoted.

"We have known all through these years that at any time we might be privileged to be at Kew we would be taken into the family and made to feel essentially like members of the staff; our visits have been profitable and delightful. May I express to Dr. Hill our profound conviction that under his administration the laurels of his great institution will become more and more luxuriant!"

Remarks were made also by Professor John M. Coulter, Dr. H. H. Rusby, Professor Robert A. Harper, Dr. C. Stuart Gager, and Dr. William Crocker, and Dr. Hill made a felicitous response to the greetings of his host and the addresses of the other speakers.

Dr. Hill came to America primarily to attend the International Congress of Plant Sciences at Ithaca in August. Afterwards, he visited points of special interest in the United States and Canada and delivered several lectures at the University of California.

MARSHALL A. HOWE.

DIFFICULTIES IN PROPAGATION[1]

The matter of propagation in horticulture and in the nursery trade has been forced to the urgent attention of American plant producers recently by the national plant quarantine law. This law was designed to protect the United States against the further importation of bad insect pests and plant diseases. While the law will meet this end, it has at the same time put the nurserymen up against great difficulties. They must suddenly begin propagating plants that they formerly bought already propagated from Europe. In many such cases they know little about the methods that will prove successful.

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, October 23, 1926, by the Director of the Boyce Thompson Institute for Plant Research.

The horticulturalist also has many unsolved problems in propagation that have long needed careful study. Amongst these may be mentioned germination of hybrid seeds of various fruits and ornamental plants, the rooting of cuttings of the same, the forcing of tubers and bulbs, and the relation of scions and stocks in grafting. The field of plant propagation has been notoriously lacking in careful scientific study that would lay a foundation for improved practice.

Because of this need in plant production, Boyce Thompson Institute for Plant Research has been giving considerable attention to propagation studies during the last two or three years. These studies have included seeds that are difficult to germinate, the rooting of cuttings that give especial difficulty, and the forcing of bulbs and tubers. The work will later be extended to cover problems in grafting.

Propagation from Seeds

One might think that germinating seeds is an easy task that needs no special thought or care. Plant them and they will grow! This is true, in general, of our common farm and garden seeds, but it is not true of a large number of the seeds with which horticulturalists and nurserymen have to deal. A nurseryman recently marked with "S" all the plants in his catalog that he ordinarily grows from seeds and, in addition, checked the ones marked with "S" that give him special difficulty in germination. It turned out that sixty per cent. of the plants propagated from seeds showed difficulties in germination.

Different horticultural seeds call for very different treatment in order to produce plants economically. One can not hope to discuss all of these. We may, therefore, mention one sort of treatment that works on the seeds of a great number of plants; the storage of the seeds for a considerable period in moist sand, peat, or soil at a low temperature –low temperature stratification. Such storage, or stratification, brings about changes in the seeds that enable them to germinate promptly and with vigor. This is the sort of thing that seeds that fall to the ground in the autumn experience during the winter under the cover of fallen leaves or dead vegetation. In practice, however, one can improve greatly on nature because he can give the seeds the most favorable tem-

perature for the proper length of time. In stratification, freezing is not necessary or even desirable. The best temperatures for stratification are a little above the freezing point. It lies somewhere between 32° F. and 50° F. for the various seeds studied. Amongst the seeds that need this sort of treatment are those of our deciduous temperate-zone fruits, Cornuses, lindens, fall-fruiting maples, temperate-zone roses, Cotoneasters, and many other rosaceous and other forms.

I might give one illustration of the significance of this knowledge on stratification. A certain agricultural experimental station had been hybridizing peaches for six or seven years, hoping to produce new and more desirable kinds. The inability to germinate the hybrid seeds proved a great hindrance. The best yield obtained was 25 seedlings from a thousand seeds. By applying these low temperature stratification methods to some of last year's seeds, they were able to approximate complete germination. This multiplied many fold the chances of getting new desirable forms.

Besides difficulties in germination, propagation from seeds raises questions on the methods of harvesting, curing, and storing of the seeds and on prevention of "damping off" and other diseases in the seed beds. These matters, too, are getting full attention.

Propagation by Cuttings

The work on cuttings by Dr. Zimmerman and Mr. Hitchcock is showing that many forms thought to be very difficult or impossible to propagate by cuttings can be rather easily propagated thus when the right methods are used. Here might be mentioned the pink dogwood, Christmas holly, and Chinese cherry. A very small change in method of handling often means much in the success of the operation. For instance, in many soft wood cuttings the percentage and rate of rooting is greatly increased by leaving the lower leaves on and burying the cuttings deeply in contrast to the more common practice of removing the lower leaves and burying less deeply. In many cases the time of taking the cutting is of great importance. This is especially true of soft wood cuttings. Here the best results are obtained in May or June. It also holds for Christmas holly where any age of wood will root. With it the best time to take the cutting is late summer or early fall.

In some cases the position in the stem from which the cutting is taken is of prime importance. Again the position of the basal cut in relation to the node and many other factors, that might seem trivial, spell the difference between success and failure.

Forcing of Bulbs and Tubers

Dr. Denny has already worked out a method by which he can eliminate the nine to twelve weeks' rest period in potato tubers. This promises to eliminate much of the loss from degeneration diseases in the fall crop of Bermuda and Cuba potatoes by making possible the use of northern-grown disease-free seed. It should also aid in potato production in many other places. Out of about two hundred twenty five different chemicals, Dr. Denny has found several that are effective and one that is highly effective and practicable, ethylene chlorhydrin. Similar work is being done on various bulbs.

The aim of this work on propagation is to increase the efficiency and reduce the cost of production of fruit and ornamental plants. While such aims will be approved by all for fruit plants they may not be so readily accepted for ornamentals. However, if one stops to figure the enormous amount of money spent on ornamentals already and the great annual increase in this ex penditure to beautify our homes, parks, driveways, golf grounds, etc., he will see that increased efficiency here means much to the country. Better methods of propagation will also insure the perpetuation and multiplication of many beautiful forms of plants that are threatened with destruction. Such work will also add to man's storehouse of exact organized knowledge which is, after all, his richest possession.

WILLIAM CROCKER.

NORTH AMERICAN ARCTIC–ALPINE VEGETATION[1]

The larger differences of vegetation in different parts of North America are associated with differences in climate. In traveling northward from the latitude of New York, broadleaf forests be-

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, September 18, 1926.

come gradually replaced, as the climatic type, by evergreen forests of spruce and fir, which extend north toward the Arctic. Good-sized trees, some of them more than 400 years old, grow as far north as the Arctic circle, but, for the most part, forest gives way in this region to scrub, the trees commonly becoming dwarfed and bushy in habit. Stunted spruces, scarcely 18 inches in height, may be 150 years in age. Along the northern border of this continent most of the country is occupied by treeless Arctic wastes: the so-called barren grounds or tundra. The prevailing plants here are perennial herbs, dwarf shrubs, and "reindeer moss."

In climbing the high mountains of temperate regions one passes through a series of climatically determined vegetation belts which are essentially identical with those passed through in traveling northward into the Arctic at a low elevation. In fact, the vegetation of Alpine summits here represents, in a way, the vegetation of the Arctic transplanted into temperate regions.

Some of the more striking features of the Alpine vegetation of the White Mountains, the Colorado Rockies, and the Cascade Mountains of western Washington were described by means of slides.

Tree limit in the White Mountains lies around 5,200 feet. The forests in the vicinity of timberline are of the same scrubby sort as those found in the Arctic. Among the most characteristic plants above timberline are various herbs and low bushes which range far to the north, in the United States being found only on Alpine summits.

In the Rocky Mountains, timberline lies between 11,000 and 12,000 feet, varying greatly in elevation with differences in exposure, etc. The most fascinating feature here is seen in the fantastic forms of the dwarfed and wizened trees which form the upper outposts of the forests. These were graphically depicted by numerous photographs. Above timberline are vast expanses of Alpine meadows: the real Alps.

The Cascade Mountains of the Pacific Northwest are famed afar for their so-called Alpine gardens. These are best developed at the upper limits of forest growth, around 5,500 feet elevation, where they present a gorgeous floral display, unsurpassed for brilliancy and spectacular effect, even by those of the Swiss Alps.

GEORGE E. NICHOLS.

IN BRITISH GUIANA JUNGLES[1]

There are few places where the jungle presses so closely upon civilization as in British Guiana. From Georgetown, with all the appurtenances of twentieth century progress, a dozen miles may carry the traveler into the haunts of the howling baboons. Also from Georgetown a system of steamboats and launches takes the explorer in safety and comfort through miles of primitive forest and past villages of aboriginal Indians far inland to Kaieteur Falls, eight hundred feet high and one of the most imposing waterfalls of the world.

A luxuriant development of tropical rain-forest, accessible in a few minutes walk from comfortable hotels or rest-houses, makes British Guiana a favorable site for scientific exploration and research, and numerous scientists from the United States have already studied its fauna and flora.

Not all of the land is occupied with forest, nor is all of it as level as the coastal strip, the only part which the ordinary visitor to Georgetown sees. Far to the southward along the Brazilian border are extensive savannas, rolling hills covered with grasses and intersected by strips of forest along the streams. Here cattle raising is an important industry and has a great future when railroads are extended into the country. To the west, where British Guiana adjoins Venezuela and Brazil, the country rises into mountains, culminating in the famous and almost mystical Roraima, whose densely forested lower slopes and rocky plateau-like summit still await careful exploration by the botanist and zoologist. It is not probable that they will find either dinosaurs or ape-men, but they can be assured of finding scores, if not hundreds, of new kinds of plants and animals which are as yet completely unknown to science. The same mountain region also produces gold and diamonds, which, washed down the mountain streams, are now mined from the alluvial deposits along the lower courses of the rivers.

The jungle itself, the dense forest which covers some 77,000 square miles, or nearly 90 per cent. of the area of the colony, has a fascination for every visitor. Mile after mile it stretches across

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, September 4, 1926.

the land, unbroken by road or railway, untouched by man except in the widely scattered clearings of the native Indians. Through it the only highways are the rivers and the only means of travel the native canoe. But it represents an enormous potential asset in the wealth of British Guiana, and even now the United States and Europe are turning more and more to it and other similar forests of the tropics for their supply of hardwood. Here is the only source of greenheart, one of the most valuable woods of the world for strength and durability and fully comparable with the Asiatic teak. Other species yield wood, equal to or surpassing American hickory, and suitable for spokes, tools, and similar articles, and still others have a grain and a color that make them suitable for the best furniture. Four-fifths of the forest land is now owned by the Crown and will ultimately yield an immense revenue to the government, while the cleared land, with its abundant rain and perpetual summer, will produce great crops of sugar, rice, and other tropical food plants.

H. A. Gleason.

THE DAVID LYDIG FUND

By the provisions of the will of Judge Charles Patrick Daly, one of the original incorporators of The New York Botanical Garden, and a member of the Board of Managers from its formation in 1895 until his death in 1899, the Garden received its first legacy.[1]

Section 5 of Article 8 of his will provided that

"All the balance of the said rest, residue and remainder of my estate which shall remain after the payment of the foregoing devises, legacies and bequests in this eighth article of my will specified, I give, devise and bequeath as follows: One-twelfth part thereof to The New York Botanical Garden as and for a memorial of my wife's late grandfather, David Lydig, the amount of said bequest to be used and expended by said corporation in such manner and for purposes as the Board of Managers thereof may deem for the best interests of the Botanical Garden."

At a meeting of the Board of Managers held April 13, 1901, the following resolution was adopted:

[1] Jour. N. Y. Bot. Gard. 2: 105, 106. 1901.

"*Resolved,* That the bequest of the late Judge Charles P. Daly from his residuary estate, as provided by Section 5 of Article 8 of his will, be and is hereby set apart and named "The David Lydig Fund bequeathed by Charles P. Daly," and that the income of this fund be devoted to publication as the Board may appropriate it from time to time."

There has been no modification of this action, and the income of this fund has, thus, aided the publications of the Garden during twenty-five years.

The principal is $34,337.86, yielding about $1,600.00 annual income. This aid in publication has been acknowledged on the title-pages of many volumes by the record "Published by the aid of the David Lydig Fund bequeathed by Charles P. Daly." These publications include 27 volumes of JOURNAL, 18 of MYCOLOGIA, 13 of BULLETIN, 7 of MEMOIRS, and 12 of CONTRIBUTIONS, 77 volumes in all. NORTH AMERICAN FLORA, of which 56 parts have been published, has also been aided by this income.

This fund, while not nearly meeting the whole expense of publications, is of great value in facilitating the distribution of botanical information.

Money received from sales and subscriptions is added to the income of the Lydig Fund and expended for publications only.

N. L. BRITTON,
Director-in-Chief.

THE 1926 DAHLIA COLLECTION

The season of 1926 ranks among the most successful of the nine seasons in which the dahlias have been specially featured among the floral displays at The New York Botanical Garden. The month of June was rather too cool and dry for the best development of the plants, but the copious rainfalls of July and August (6.19 and 6.52 inches) seemed to be about what they required to start them to growing healthily and blooming freely. The collection numbered 997 plants and 420 varieties. The contributors of new varieties of outstanding merit remained about the same as listed in the JOURNAL in previous years, but newcomers among those who have generously made the Garden's dahlia exhibit possible included Mrs. C. R. Stewart Leckie,

FIGURE 1. A part of the Dahlia collection at The New York Botanical Garden, October, 1926. The eastern border, with orange-flowered varieties at the south (right) end and pink flowered varieties at the north end.

Greenwich, Conn.; Blue Ribbon Dahlia Company, Trenton, N. J.; Nathan A. Miller, Branford, Conn.; Wyoming Dahlia Gardens, Maplewood, N. J.; Success Dahlia Gardens, Lawrence, Mass.; Chemar Gardens, Oyster Bay, N. Y., and the Henry F. Michell Company, Philadelphia, Pa.

The popularity of dwarf small-flowered bedding varieties in Great Britain led to the purchase of nine such varieties from a firm in Wales. In accordance with instructions, these varieties were started earlier than is customary with us and perhaps for that reason or because the plants were not cut back at the right time, they did not make an especially good showing, with the exception of the variety Coltness Gem. The success of this variety indicates its use another season for bedding purposes. It is so dwarf that it requires no staking and, if planted fifteen or eighteen inches apart, it should cover the ground completely by September.

The dahlia collection received numerous press notices and during the season it was visited by thousands of people. On October 5, representatives of neighboring garden clubs, especially those affiliated with the Federated Garden Clubs of New York State and the Garden Club of America, made a visit to the Botanical Garden as guests of the Advisory Council, for the special purpose of inspecting the dahlia collection. After an illustrated lecture on "Dahlias" by the writer of the present note, tea was served.

Killing frost put an end to the dahlias on October 22. The record of the killing frosts for the nine successive years is as follows: 1918, November 7; 1919, November 10; 1920, November 13; 1921, October 26; 1922, October 21; 1923, November 2; 1924, October 23; 1925, October 29 (following serious injury by a cold gale on October 10); 1926, October 22.

MARSHALL A. HOWE.

ENGLISH GARDENS[1]

England is a nation of gardeners. Probably in no other country in the world has ornamental horticulture attained such high

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, August 28, 1926.

FIGURE 2. A detail of the eastern dahlia border at The New York Botanical Garden, October, 1926, showing the varieties Sherlock, Jean Chazot, Robert Scott, Countess of Lonsdale, etc.

standards as in England. The love of plants and gardening is universal among all classes of the population.

Gardens of hardy plants, rather than plants which have to be grown in hot houses, seem to have the greatest hold on the English people at the present time. As a phase of hardy plant growing the rock garden seems to hold a pre-eminent position. Every garden visited had a rock garden of some kind or another. The herbaceous border has for many years been a favorite feature in many of the gardens of England and of recent years the interest in hardy plants has given this style of gardening great impetus. One of the most famous herbaceous borders in England and in the world is the one at Hampton Court, which is always interesting and beautiful throughout the whole growing season. Although the tendency in England is towards the informal and natural in gardening, yet the more formal style of gardening is not neglected, especially in the public gardens and on some of the large private estates.

The lecture was illustrated by about 100 beautifully colored slides of the various types of garden, including rock, herbaceous, wild, and water garden. Some pictures showing examples of trained fruit trees, a form of gardening seldom seen in this country, were also shown.

MONTAGUE FREE.

SMALL GARDEN COMPETITION UNDER AUSPICES OF THE NEW YORK BOTANICAL GARDEN, 1927

A. *Purpose.*—The keynote of this competition is to popularize possibilities in the treatment of small (one man or woman) gardens with a maximum of taste and a minimum of expense. This must be kept constantly in mind by all competitors.

B. *Open Competition.*—The competition is open to all persons, professional or amateur, other than landscape architects and employees or members of staff of The New York Botanical Garden.

Copies of this program may be obtained at The New York Botanical Garden or will be mailed on request.

C. *Prizes.*—The first prize is $100 cash. The New York Botanical Garden also undertakes, during the spring or early summer of 1927, to lay out and plant, in a prominent location in its

grounds, a garden on the lines of the winning design, and maintain the same as a public exhibition prize garden for at least one year.

The winner of the second prize will receive $75 cash.

The winner of the third prize will receive $25 cash.

D. *Publicity.*—Wide publicity will be given to this competition; the names of the winners will be published and due credit for the authorship of the winning plan will be accorded on any public notice which may be posted in or on the prize garden referred to in the preceding paragraph.

E. *Jury of Award.*—The jury will consist of three distinguished garden experts—one nominated by The Garden Club of America, one nominated by The Federated Garden Clubs of New York State, and one by The New York Botanical Garden.

F. *Conditions.*—(1) The plot to be covered is approximately 40 x 52 feet. These dimensions must be strictly observed. All plans must be scaled ¼ inch to the foot.

(2) No competitor may submit more than one plan.

(3) Plans shall be rendered in ink on mounted drawing paper, size of sheet 13″ x 18″. Color may be indicated but no perspective, picture, or photograph will be considered. If, however, a fence, pergola, or other construction is contemplated and can not be easily described, a simple sketch sufficient to indicate the idea may be submitted.

(4) Every plant, shrub, etc., must be given a key number and its position clearly located on the plan.

(5) The character of all material employed must be plainly indicated on the plan, which may also describe any special purpose which the garden is intended to serve, such as "Front Yard," "Back Yard," or "Suburban Garden."

(6) Each plan must be accompanied by a legible specification of all plants or shrubs employed, detailing the color, quantity, and the key number thereof. No expensive plants or shrubs are to be used. Annuals are permissible, but hardy perennials are preferred. Regard must be had for maintaining a succession of bloom for spring, summer, and autumn, with harmonious color as the keynote and with due consideration of climatal conditions. A fence, pergola, brick or stone path, or any other appropriate accessory may be indicated; but no construction work is to be

suggested which renders highly skilled labor imperative. In considering cost, the jury will assume that all plants are to be developed from cuttings, roots, divisions, bulbs, or seeds to minimize expense.

(7) The winning plans (1st, 2nd, and 3rd prizes) shall be the sole and exclusive property of The New York Botanical Garden, which shall own the copyright, photograph rights, and every other right and title connected therewith.

If full postage be included for that purpose, unsuccessful plans will be returned. But all plans submitted are wholly at the senders' risk and The New York Botanical Garden assumes no responsibility therefor.

G. *Submission of Plans.*—I. Plans must be submitted on or before 12 o'clock (noon) of the first day of March, 1927. No plan received after that day and hour will be considered.

II. Plans must be addressed to

Prize Garden Competition,
The New York Botanical Garden,
Bronx Park, New York City.

The wrapper must have no name or symbol identifying the sender.

III. Each plan must be forwarded flat or rolled (not folded). To it there must be firmly attached a plain, sealed, opaque envelope containing the name and address of the sender. No identification mark of any kind must appear on the envelope, plan or specification. Disregard of this requirement will absolutely disqualify the sender. Each envelope and plan will be marked as received for identification by the Committee but no envelope will be opened until the jury shall have rendered its decision.

In the first Small Garden Competition, conducted under conditions essentially as above, the awards made in March, 1926, were as follows:

1. The first prize of One Hundred Dollars to Mr. Archie S. Hill, Wauwatosa, Wisconsin.
2. The second prize of Seventy-five Dollars to Mrs. William Harris Cary, Brooklyn, New York.
3. The third prize of Twenty-five Dollars to Mr. L. L. Blundell, Brookline, Massachusetts.

A garden in general accordance with the first-prize plan was laid out and planted by The New York Botanical Garden, early in 1926, a little to the northeast of Conservatory Range 1. It has attracted wide attention and will be maintained as a public exhibit in 1927. The three prize-winning plans were published in the JOURNAL OF THE NEW YORK BOTANICAL GARDEN for April, 1926.

PUBLIC LECTURES DURING NOVEMBER

The following is the program of the illustrated lectures given in the Museum Building of The New York Botanical Garden on Saturday afternoons in November. They begin at 3:30; doors are opened at 3:45 to admit late comers.

Nov. 6. "Chrysantheinums," Mr. Kenneth R. Boynton.
Nov. 13. "Fossil Plants of New York City and Vicinity," Dr. Arthur Hollick.
Nov. 20. "Outdoor Roses," Mr. F. L. Atkins.
Nov. 27. "Nature-Study in National, State, and County Parks," Mr. Raymond H. Torrey.

NOTES, NEWS, AND COMMENT

Under the direction of Professor William Gould Vinal, a group of young men and women in training for Recreation Leaders in the First National Training School of the Playground and Recreation Association of America visited the Garden on October 9th and were escorted through buildings and grounds by Mr. Wilson.

Mr. William Fawcett, who was for many years Director of Public Gardens and Plantations of the Island of Jamaica, died in London, England, on August 16, 1926. During his term of service in Jamaica he cordially coöperated with Dr. and Mrs. Britton in their several visits to that island, 1906–1908, for the study and collection of West Indian plants. Subsequent to his retirement from the British government service in 1908, and his return to England, he has prosecuted studies of the Jamaica flora with Dr. A. B. Rendle, at the British Museum of Natural History, the results of which have appeared in four volumes of their "Flora of Jamaica," a noteworthy contribution to the botany of the West Indies, not yet completed. We deplore his loss and much regret that he did not live to see this work finished.

Dr. Clyde Fisher, Curator of Visual Instruction and in charge of astronomy at the American Museum of Natural History, gave a lecture on "Autumn Flowers" at The New York Botanical Garden, October 16, making special reference to the dispersal of seeds in nature. Among those depending upon the wind for distribution, he described several with flying hairs, like the dandelion and thistle. He showed examples of seeds with wings as the maple and those that are blown across the field and prairies like the tumble-weeds of the west. He then treated those that depend upon the water for distribution and then those that depend upon both water and wind like the Lotus. He also showed some devices for holding on to the furry coats of animals, etc., found in fruits with hooks, as in the various burrs like the beggar-ticks and burdock burrs; birds as carriers of seeds, as in lumps of mud on water-fowls' toes or hard-coated seeds in edible fruits; the function of mice and squirrels in transporting and planting the seeds of nut-bearing trees. The lecture was illustrated by beautifully colored lantern slides.

Meteorology for October. The total rainfall at The New York Botanical Garden for the month was 4.53. The maximum temperatures recorded for each week were *82° on the 3rd,* 80° on the 5th, 71° on the 12th, 67° on the 24th and 65.5° on the 29th. The minimum temperatures were 37° on the 10th, 33.5° on the 16th, 31.5° on the 22nd (the first killing frost), and 31° on the 28th.

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MUSEUMS AND HERBARIUM

200 specimens, "North American Uredinales," centuries 34 and 35. (Distributed by Mr. Elam Bartholomew.)

9 specimens of fungi from North Dakota and South Dakota. (By exchange with Dr. J. F. Brenckle.)

1 specimen of fungus from Pennsylvania. (By exchange with Dr. L. O. Overholts.)

311 specimens of fungi from Santo Domingo. By exchange with Insular Experiment Station, Porto Rico.)

1 specimen of *Prunus maritima* from New Jersey. (Given by Dr. N. L. Britton.)

57 specimens of woody plants from Central America. (Given by Dr. Samuel J. Record.)

1 specimen of *Solidago erecta* from Virginia. (Given by Dr. W. A. Murrill.)

786 specimens from South America and China. (By exchange with the Museum of Natural History, Paris.)

18 specimens of flowering plants from Florida. (Given by Dr. R. M. Harper.)

1 specimen of *Malpighia glabra* from Texas. (By exchange with Mr. Edward Teas.)

1 specimen of *Galinsoga parviflora* from New Jersey. (Given by Dr. Hudson Maxim.)

6 specimens of flowering plants from Santo Domingo and Porto Rico. (Given by Professor F. D. Kern.)

2 specimens, *Passiflora gracilens* and *Tetrastylis lobata.* (By exchange with the United States National Museum.)

100 specimens, "North American Grasses." (By exchange with the United States Department of Agriculture.)

10 specimens of mimosaceous plants. (By exchange with the United States National Museum.)

13 specimens of *Rubus* from China. (By exchange with the Royal Botanic Gardens, Kew, England.)

1 specimen of *Utricularia mixta* from the Canal Zone. (Given by Mr. C. W. Dodge.)

15 specimens of flowering plants from North Carolina. (By exchange with Professor B. W. Wells.)

6 specimens of flowering plants from St. Thomas, Virgin Islands. (Given by Mr. Arthur S. Fairchild.)

16 specimens of *Solidago.* (Given by Mr. E. J. Palmer.)

12 specimens of American mimosaceous plants. (By exchange with the United States National Museum.)

2 specimens, *Oakesiella* and *Trillium,* from New York. (Given by Mr. E. J. Alexander.)

12 specimens of flowering plants from Trinidad. (By exchange with the Agricultural Experiment Station, Port of Spain, Trinidad.)

1,480 specimens of ferns and flowering plants from North America (By exchange with the Academy of Natural Sciences of Philadelphia.)

1,360 specimens of flowering plants from Peru and Chile. (Collected by Dr. Francis W. Pennell.)

2 specimens of flowering plants from the Mohave Desert, California. (Given by Dr. Anstruther Davidson.)

102 specimens of flowering plants from Mexico. (By exchange with the United States National Museum.)

30 specimens of flowering plants from Cuba. (Given by Brother León.)

714 specimens of flowering plants from California and contiguous territory. (By exchange with Pomona College.)

1 specimen of *Riccia Elliottii* from the Panama Canal Zone. (Given by Professor Alexander W. Evans.)

16 specimens of marine algae from Newfoundland and Province of Quebec. (Given by Mr. Frits Johansen.)

1 specimen of *Halimeda discoidea* from Washington Island, Pacific Ocean. (Given by Professor W. A. Setchell.)

3 specimens of Hepaticae from Louisiana. (Given by Miss Caroline C. Haynes.)

2 specimens of *Lithothamnium incertum* from the Dry Tortugas, Florida. (In exchange with Dr. W. R. Taylor.)

1 specimen of *Dictyota dilatata* and 1 specimen of *Turbinaria filamentosa* from Japan. (By exchange with Mr. Y. Yamada.)

4 specimens of marine algae from Labrador. (By exchange with the United States National Museum.)

1 specimen of *Protoderma viride* and 1 specimen of *Aphanothece saxicola* from Long Island, N. Y. (Given by Mr. Roy Latham.)

3 specimens of fresh-water algae from Arkansas. (By exchange with the United States National Museum.)

2 specimens of *Riccia* from Texas. (Given by Dr. F. McAllister.)

1 specimen of *Sphaerocarpos texanus* from Texas. (By exchange with the United States National Museum.)

1 specimen of *Sargassum Palmeri* from Guadalupe Island. (By exchange with the United States National Museum.)

160 specimens of marine algae from Florida. (By exchange with Professor William R. Taylor.)

139 specimens of algae, 31 specimens of mosses, and 28 specimens of lichens, mostly from the South Sea Islands. (By exchange with the University of California.)

26 specimens of marine algae from Friday Harbor, Washington. (By exchange with Lund University.)

40 specimens of marine algae from Japan and Formosa. (By exchange with Mr. Y. Yamada, Botanical Garden, Tokyo, Japan.)

3 specimens of Hepaticae from Connecticut. (By exchange with Miss Annie Lorenz.)

2 specimens of *Riccia Frostii* from Colorado. (Given by Dr. F. McAllister.)

9 specimens of flowering plants from Chenango County, New York. (Given by Mrs. L. B. Fairbanks.)

450 specimens of ferns and flowering plants from Brazil. (By exchange with the Riksmuseum, Stockholm, Sweden.)

1 specimen of *Houstonia Croftiae.* (By exchange with the Missouri Botanical Garden.)

1,212 specimens of flowerless and flowering plants from Peru, collected by G. H. H. Tate. (Given by the American Museum of Natural History.)

1 specimen, fossil wood of *Juniperus communis.* Pleistocene (?) swamp deposit. Manhattan Island. (By exchange with the American Museum of Natural History.)

16 specimens, fossil wood and walnuts. Pleistocene (?) clay deposit. Porto Rico. (Given by Mr. Adriano Gonzales.)

2 specimens, *Phragmites aquehongensis.* Quaternary morainal deposit. Staten Island. (Collected by Dr. Arthur Hollick.)

5 specimens, seeds of *Nelumbo* sp. Recent swamp deposit in southern Manchuria. (Given by Mr. Ichiro Ohga.)

211 grasses from Brazil. (Collected by Mrs. Agnes Chase.)

10 photographs of American mimosaceous plants. (By exchange with the United States National Museum.)

197 specimens of Melastomaceae. (By exchange with the Riksmuseum, Stockholm, Sweden.)

4 specimens of flowering plants from North Carolina. (Given by Dr. Edgar T. Wherry.)

34 specimens (22 plants and 12 photographs) of North American plants. (By exchange with the United States National Museum.)

PLANTS AND SEEDS

60,000 bulbs, Tulips. (Given by the Dutch Bulb Exporters' Association.)
6 plants, *Iris* sp. (Given by Mrs. W. H. Peckham.)
3 plants from Panama. (Given by Mr. C. D. Mell.)
42 plants for Arboretum. (Given by Oxford Paper Co.)
66 plants for Conservatories. (By exchange with the B. P. I., United States Department of Agriculture.)
1 plant, *Amorphophallus*. (Given by Mrs Augusta F. Muller.)
1 plant, *Gasteria* sp. (Given by Mrs. Charles H. Stout.)
4 plants, *Opuntia* sp. (Given by Mrs. Allan Marquand.)
8 plants, *Iris* sp. (Collected by Mr. H. O'Neill.)
12 plants, *Iris* sp. (Collected by Mr. D. Demeree.)
1 plant, *Iris lacunarum*. (Given by Mr. E. S. Reasoner.)
4 plants, *Convallaria*. (Given by Mrs. Charles Hacker.)
3 plants, *Myrtus* sp. (Given by Mr. E. W. Poole.)
35 plants for Succulent House. (By exchange with Mr. Curtis Redfern.)
7 plants, *Castalia* and *Begonia*. (By exchange with Brooklyn Botanic Garden.)
563 plants, *Iris*. (Collected by Dr. J. K. Small.)
25 plants, *Hymenocallis*. (Collected by Dr. J. K. Small.)
250 plants, *Hymenocallis*. (Collected by Dr. J. K. Small.)
7 plants for Rose Garden. (Given by Bobbink and Atkins.)
100 plants, *Rhododendron Chapmani*. (Collected by Dr. J. K. Small.)
72 plants, *Iris versicolor*. (Collected by Dr. J. K. Small.)
2 plants, *Iris*. (Given by Mr. B. H. Lane.)
43 plants, *Iris*. (Given by Mr. J. C. Wister.)
12 plants, *Iris dichotoma*. (Given by Mr. H. S. Jackson.)
5 plants, *Iris*. (Given by Mr. W. McL. Ayres.)
3 plants, *Iris* (Given by Mr. E. G. Lapham.)
1 plant, *Iris*. (Given by Mr. Walter Timmerman.)

Additions to the Collection of Dahlias (1926)

140 Dahlia roots of the variety Lemur and 16 Dahlia roots, 8 varieties. (Purchased of William Treseder, Ltd.)
39 Dahlia roots, 22 varieties. (By exchange with Dr. Marshall A. Howe.)
20 Dahlia plants, 10 varieties. (Given by Mr. John Harding.)
17 Dahlia plants, 7 varieties. (Given by Chemar Gardens.)
17 Dahlia roots, 15 varieties. (Given by Slocombe's Dahlia Gardens.)
14 Dahlia roots, 7 varieties, and 4 Dahlia plants, 2 varieties. (Given by Dahliadel Nurseries.)
14 Dahlia plants, 14 varieties. (Given by R. Vincent, Jr., & Sons.)
14 Dahlia plants, 7 varieties. (Given by Mr. W. H. Waite.)
12 Dahlia plants, 12 varieties. (Given by Fisher & Masson.)
12 Dahlia plants, 6 varieties. (Given by Success Dahlia Gardens.)
12 Dahlia roots, 12 varieties. (Given by Mr. J. J. Broomall.)
11 Dahlia roots, 11 varieties. (Given by Mrs. C. R. Stewart Leckie.)

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7 Dahlia clumps, 3 varieties, and 6 Dahlia roots, 5 varieties. (By exchange with Mr. C. Frey.)
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6 Dahlia plants, 6 varieties. (Given by Mr. J. A. Kemp.)
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6 Dahlia roots, 3 varieties. (Given by Mr. Nathan A. Miller.)
6 Dahlia roots, 3 varieties. (Given by Mills and Co.)
6 Dahlia roots, 3 varieties. (Given by Wyoming Dahlia Gardens.)
5 Dahlia roots, 5 varieties. (By exchange with Mr. Paul Otto.)
5 Dahlia roots, 3 varieties. (Given by Mr. W. L. W. Darnell.)
4 Dahlia plants, 4 varieties, and 2 Dahlia roots, 1 variety. (Given by Meachen & Sherman.)
4 Dahlia plants, 1 variety. (By exchange with New Jersey Agricultural Experiment Station.)

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

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VOL. XXVII DECEMBER, 1926 No. 324

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

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JOURNAL
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RECORDS OF GLACIATION IN THE NEW YORK BOTANICAL GARDEN

(WITH TEXT FIGURES 1–7)

Any region or area of the earth's surface over which a glacier has moved presents certain features that are so striking and characteristic that, once recognized, similar features cannot fail of recognition, no matter where they may be encountered.

The most salient of these features are (a) rounded, scored, and grooved rock outcrops, (b) erratic boulders—detached rocks, mostly different in kind from those that form the rock outcrops of the immediate vicinity—occasionally isolated in some conspicuous position, and usually coarsely faceted and angled, with the edges rounded and the surface often scored or scratched, (c) rock débris or till, consisting of unassorted or unstratified accumulations of clay, sand, gravel, and boulders. Any one or all of these features may be present in a locality where a glacier has "lived and moved and had its being." They constitute the records which, when properly interpreted, tell the story that recounts the origin of the glacier, the direction in which it moved, the rock outcrops over which it traveled, and the location of the ice front at the time of its furthest advance—the place where the factor of warm temperature and consequent melting exactly balanced the factor of forward movement. Other less obvious features may also be observed, representing minor details that would, perhaps, render the story more complete, but could add but little to its impressiveness.

The records left by the continental ice sheet of the Ice Age or Glacial Epoch of the Quaternary Period, in its several advances

and retreats over this region, differ merely in degree and not in kind from those of any existing glacier, and many such records are extant, where they may be observed and studied, within the boundaries of The New York Botanical Garden.

Examples of erratic and isolated boulders are plentiful. Some have evidently traveled long distances and have undergone considerable abrasion *en route*. Their facets and angles are worn smooth and rounded. Others, on the contrary, show relatively little indication of the wear and tear of transportation. Their surfaces and edges are rough. In some instances the ice, in melting, left the boulders in strange looking positions—balanced on an uneven rock surface, so that a little pressure exerted in the right direction may cause them to oscillate, or perched close to the edge of a cliff or steep declivity, as if extending an invitation to be dislodged.

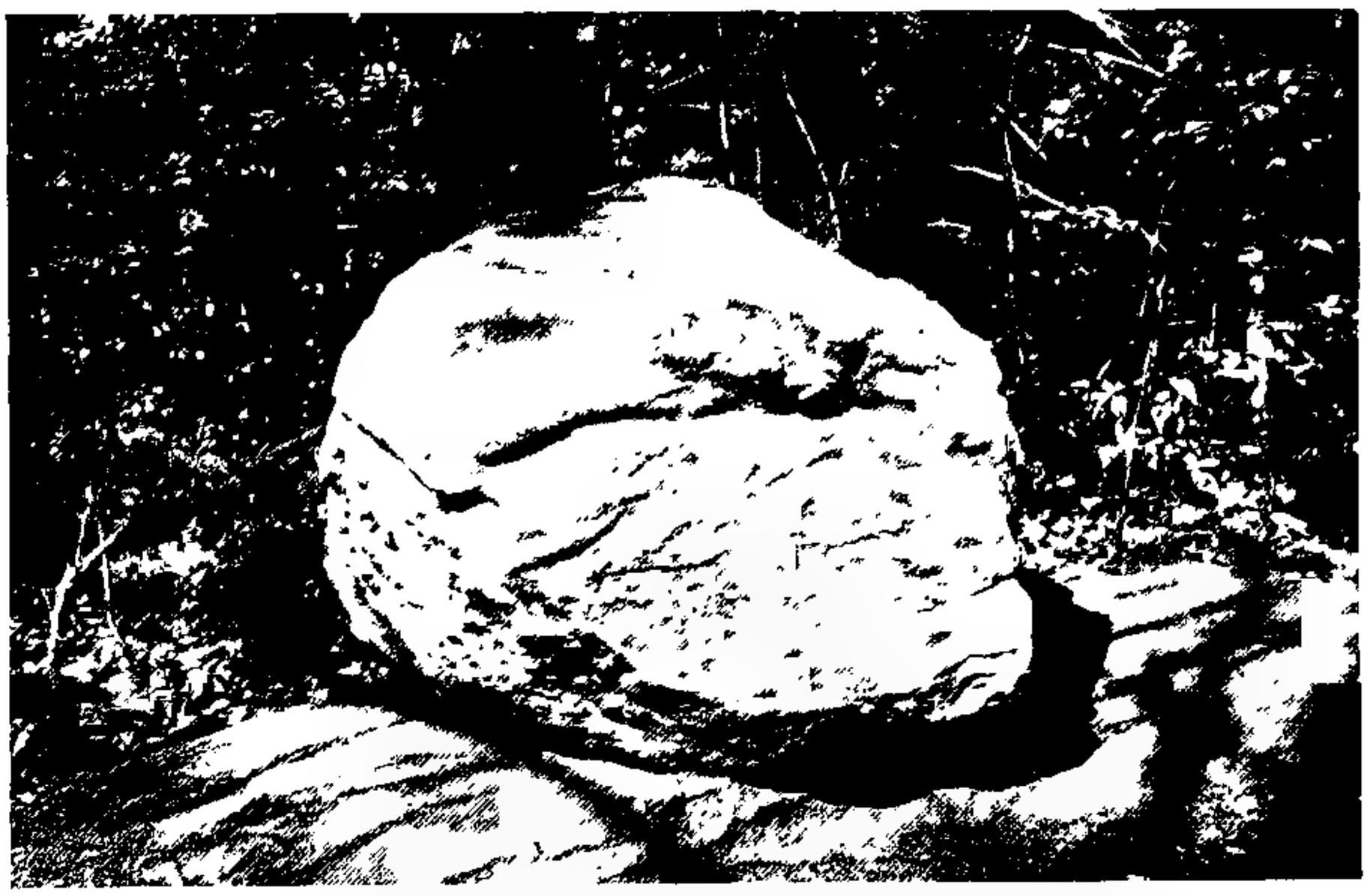

FIGURE 1. Erratic boulder in the Hemlock Grove, near southern border. Photograph by J. K. Small, October 18, 1925.

FIGURE 1 is a photograph of a boulder that rests on the eroded surface of a rock outcrop near the southern border of the Hemlock Grove. It is approximately 3.5 feet in height and 4.5 feet in lateral extent as viewed in the picture. Its rough surface and edges indicate that it was not transported for any considerable

FIGURE 2. Erratic boulder, perched on the edge of a rock ridge in woods east of the Horticultural Grounds. Photo-

distance and that its original home was not very far away. FIGURE 2 represents a boulder somewhat more rounded than the one shown in FIGURE 1. It is perched close to the edge of a cliff at the end of a rock ridge in the woods east of the Horticultural Grounds. Its dimensions are approximately 5 feet in height and 6 feet in lateral extent as viewed in the picture. The bands and irregular linear markings that may be seen extending from the base of the boulder toward the lower right hand corner of the picture represent the eroded, upturned edges of the rock strata that form the ridge.

The outcrops of Manhattan schist—the only kind of native rock exposed within the boundaries of the Garden—were planed off and rounded by the moving ice and its included débris, and in places the characteristic surface scratches and grooves, or striae, are well defined. One of the best examples in this connection is represented by a portion of the footpath along the west border of the Herbaceous Grounds, where an outcrop is exposed that reveals the eroded upturned edges of the strata, the rounded surface, and the glacial striae, so clearly that even a casual observer can hardly fail to notice them. In the accompanying two views of this outcrop (FIGURES 3A, 3B) the rock strata may be seen extending laterally from side to side in a series of broad and narrow ribbon-like markings, and the glacial striae may be seen extending from the lower left toward the upper right-hand corner of each picture. FIGURE 3A is a general view of the outcrop and surroundings, and FIGURE 3B is a close-up view of the left-hand portion of the rock surface shown in FIGURE 3A. The strike or compass direction of the rock strata is approximately N. 25°–30° E., and the compass direction of the glacial striae is approximately N. 12° W. Where they cross, therefore, they subtend acute angles toward the northwest and southeast and obtuse angles toward the southwest and northeast, as is well brought out in FIGURE 3B.

If a geological map of New York State is now consulted, and the compass direction of the striae is marked by means of a ruler, the route or path along which the ice sheet traveled in its journey to our region, and the outcrops of the geological formations over which it passed may thus be indicated. Southward it is soon lost in the sea, but northward it may be followed across the Hudson River in the vicinity of Tappan, thence over the Shawangunk,

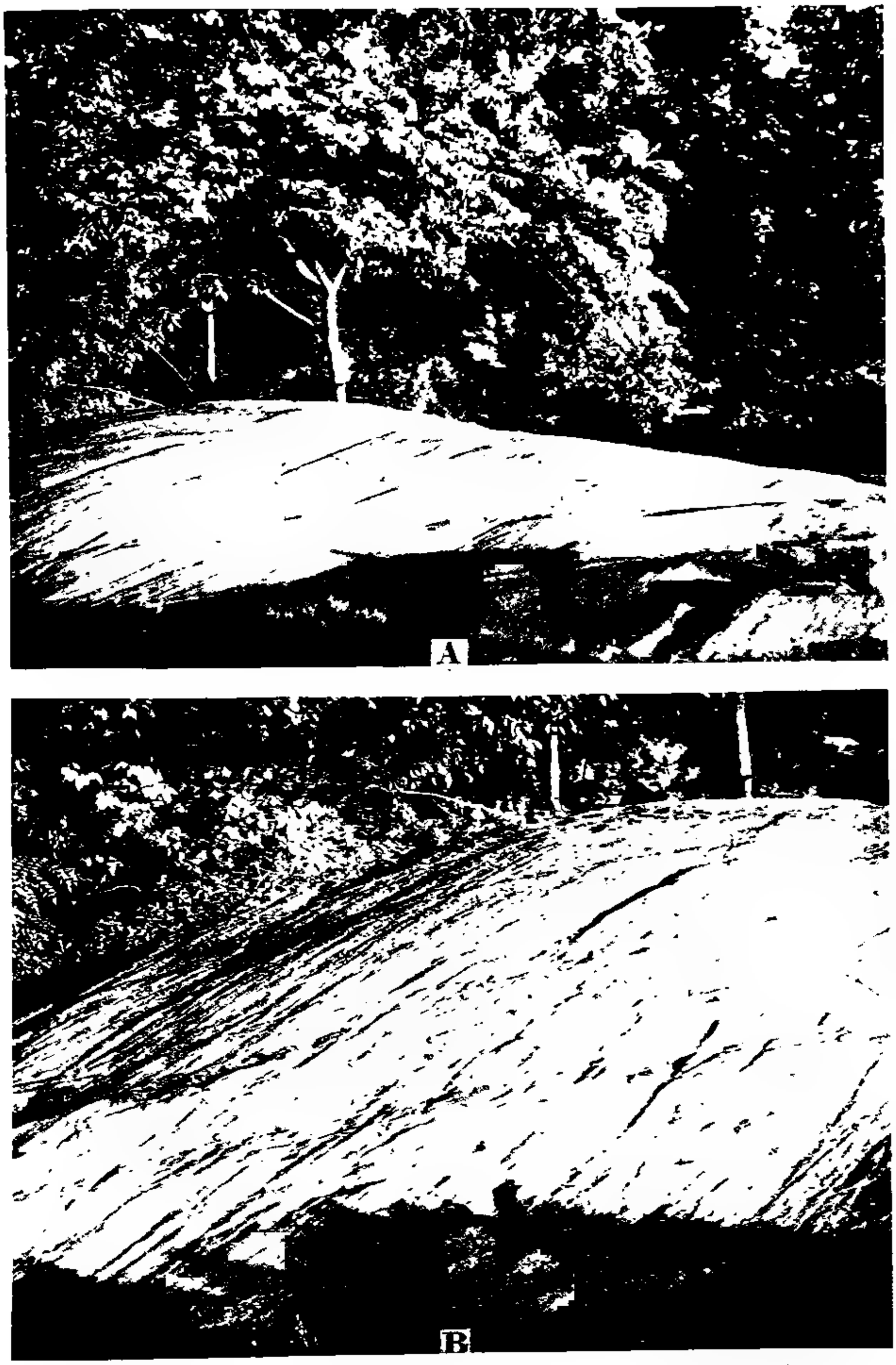

FIGURE 3A. Rock outcrop exposed in path west of the Herbaceous Grounds, showing strata and glacial striae.

FIGURE 3B. Close view of left-hand portion of rock outcrop shown in Figure 3A.

Photographs by Fleda Griffith, October, 1926.

Helderberg and Catskill mountains, across the Mohawk River valley in the vicinity of Canajoharie, over the western flank of the Adirondacks, and so on through into Canada, crossing the outcrops of the formations whose rock fragments may be found included in the débris carried within or pushed ahead by the ice, and finally left stranded in the form of till and boulders where the ice melted and dropped them. Unfortunately there is not any

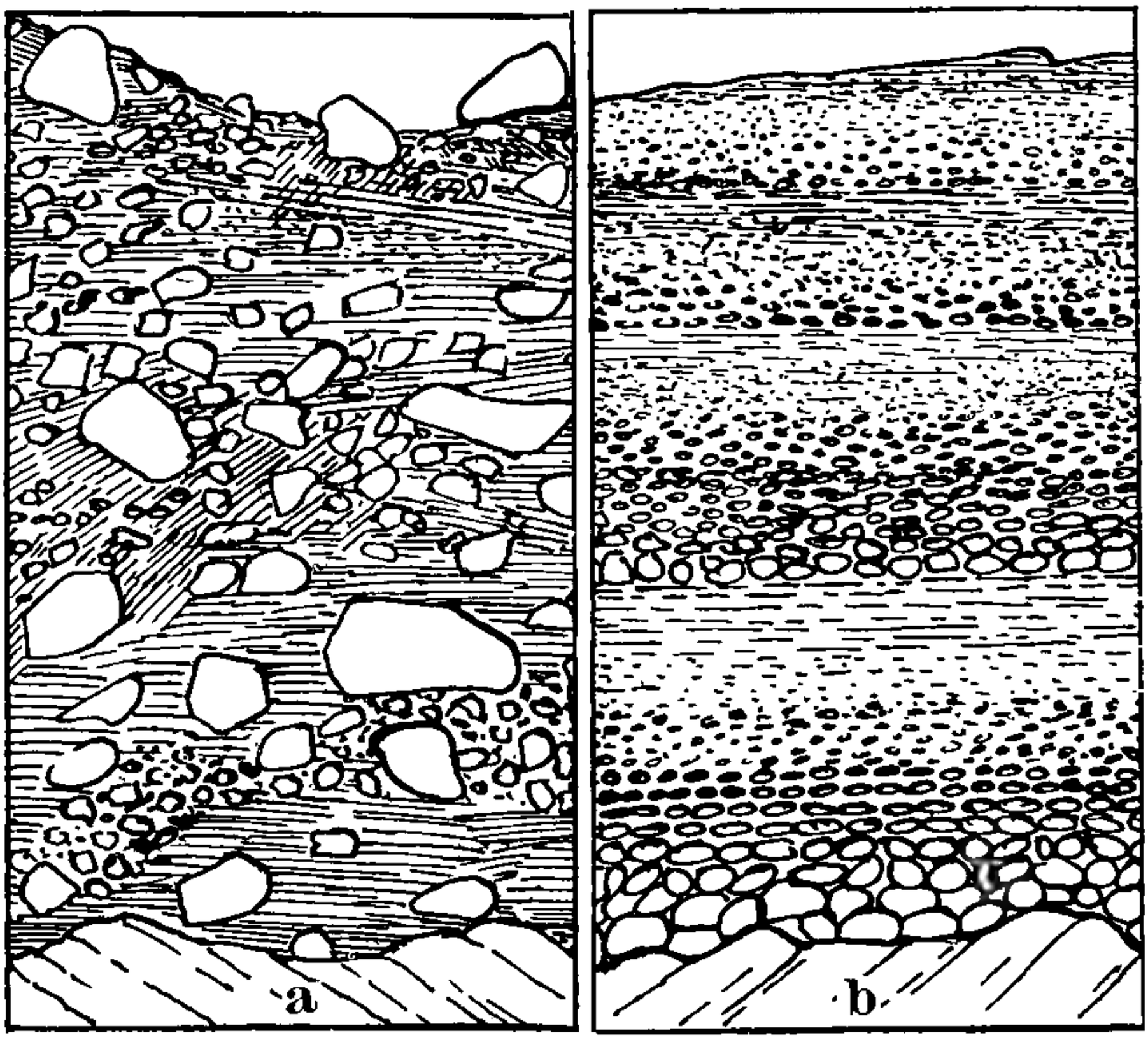

FIGURE 4a. Ideal section of ice-transported deposit.
FIGURE 4b. Ideal section of water-transported deposit.

extensive deposit of undisturbed till within the boundaries of the Garden. Most of it was swept away by the torrents that later flowed down the Bronx River valley from the melting ice front as it receded northward. Only on the tops of the higher ridges was the till preserved intact, and one such locality is represented by a limited area south of and immediately adjacent to Conservatory Range No. 2. Here a section of the till is exposed, and scat-

tered through and over it are numerous cobbles and boulders, many of which may be recognized as lithologically identical with certain of the rock outcrops—some of them representing the far Adirondack region—that lie in and across the path traversed by the ice sheet.

Water-transported and ice-transported material, when finally deposited, may be readily distinguished, one from the other. Water assorts the material that it transports and deposits, leaving

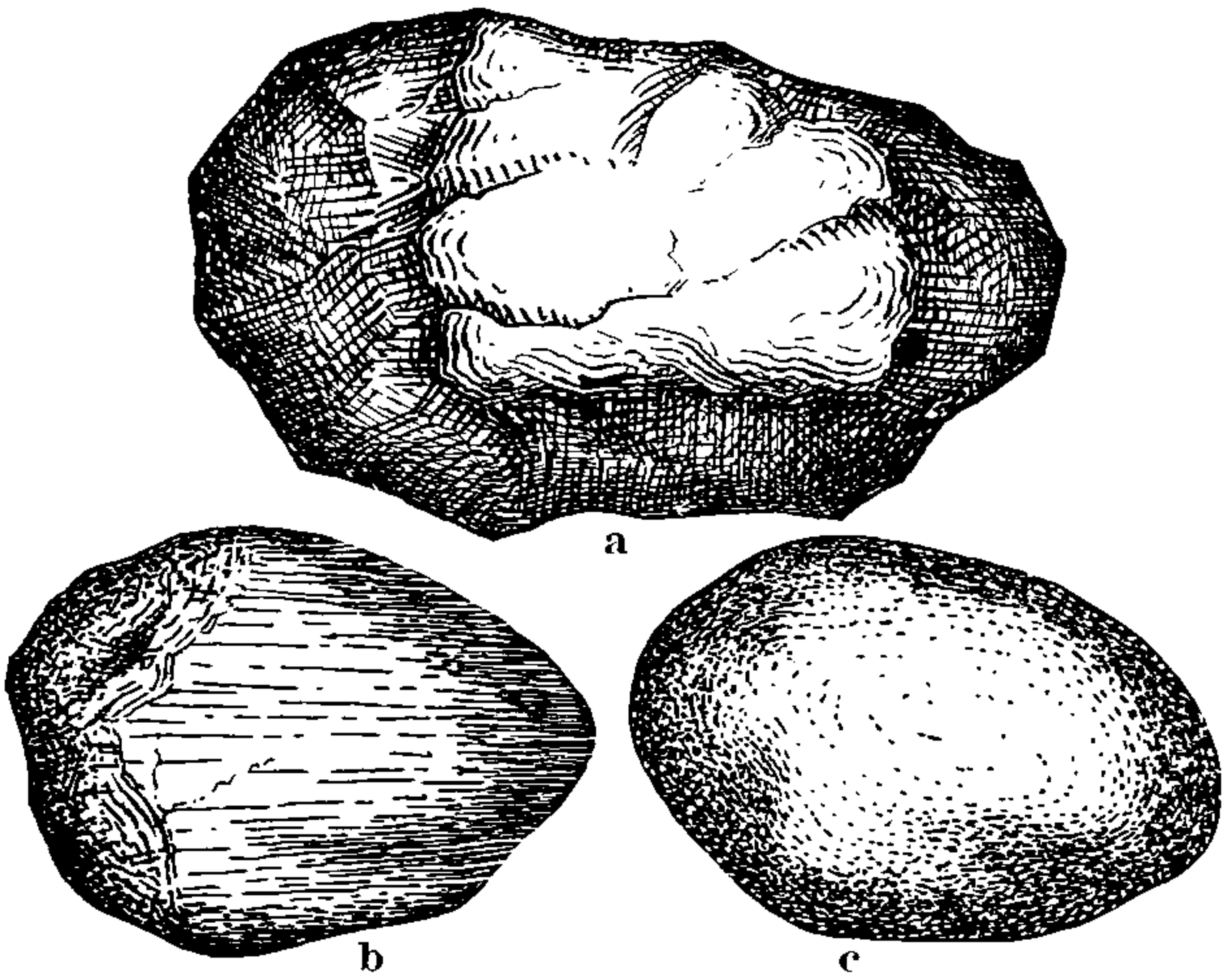

FIGURE 5a. Ideal representation of a rock fragment in its original condition.
FIGURE 5b. The same fragment after transportation by a glacier.
FIGURE 5c. The same fragment after transportation by water.

it arranged in layers, with the larger and heavier constituents at the bottom and the successively smaller and lighter constituents toward the top. In other words, the deposit is more or less bedded or stratified in a well-defined manner. Ice, on the contrary, transports and deposits its load of débris in a haphazard manner and in any sequence that may happen to obtain—sometimes the fine on top, sometimes the coarse—with the result that glacial till is usually a heterogeneous mixture of unstratified clay, sand, gravel,

and boulders. An ideal section of the latter is indicated in the sketch shown in FIGURE 4a, and a similar section of the former in FIGURE 4b.

Further than this, if individual constituents of each kind of deposit are critically examined, they may be seen to possess certain characters by means of which they may be readily differentiated. The water-transported fragments are worn more or less equally on all sides and are formed into rounded cobble-stones and gravel, due to the rolling over and over to which they have

FIGURE 6. Portion of the Boulder Bridge, viewed from down the river.

been subjected. Ice-transported fragments, on the other hand, usually retain more or less of their original faceted or angular character, for the reason that they are either carried on or in the ice and may not be subjected to abrasion, or else they are held fast in the basal ice of the glacier, or pushed along beneath it, each fragment adjusting itself mechanically in the position of least resistence the longer axis of the fragment in line with the direction of glacial movement. A fragment held and transported in such manner will retain, more or less, a fixed position and

become worn away in certain parts more than in others. The lower surface, in contact with the bedrock, is planed away, and the forward end is worn away more rapidly than the after end, so that eventually the fragment may become beveled and wedge-

FIGURE 7. Eastern end of pathway over Boulder Bridge.

shaped in front, and remain rough and faceted in the rear. FIGURE 5a is an idealized sketch, designed to represent a rock fragment in its original condition; FIGURE 5b the same fragment after transportation by a glacier; FIGURE 5c the same fragment after transportation by running water. Actual specimens similar to

and comparable with FIGURE 5b may be found in connection with the till deposit previously mentioned, and any number of specimens like FIGURE 5c may be found in the river bed or in the soil of the adjacent floodplain.

In conclusion, it may be remarked that one of these local geological features—the ice- and water-transported rock fragments—have been utilized to good advantage in the development of the Garden, as may be seen in connection with the realistic Rubble or Boulder Bridge that is such an attractive artificial feature of the river valley region. FIGURE 6 is a photograph of a portion of the bridge, viewed from down the river, and FIGURE 7 a view of the eastern end of the pathway over it.

ARTHUR HOLLICK.

TROPICAL GARDENS[1]

Up to the present the tropical garden has had no form, but plenty of spirit; no motif, but enticing fragrance, grateful shade and flashing color. The texture and fabric of mass obtainable with temperate garden and park plants cannot be duplicated with the tropical material which has been used, but this material is much more attractive individually. Nature's prodigal generosity gives all things such a rich growth in the tropics that they seem to blend somehow. A great blaze of magenta or purple, or red or orange, which one might consider hard to combine, seems, in the last tolerant analysis, appropriate to the clime and people. The veteran purple Bougainvillea, which is being improved into crimson and other varieties, is hardly ever out of place climbing over a warm-country domicile, and it is found on the most imposing residence and on the lowliest thatch roof. At the outset the word palm enters. Palms have individual beauty, avenue effect, or picturesque association values such as in the magnificent groups or groves of cocoanuts swaying together with the trade winds on tropical coasts throughout the world. They are gardens in themselves and the number of beautiful palms for tropical gardens runs into the hundreds. One small, rather bushy palm could be

[1] Abstract of a lecture and demonstration given in the Central Display Greenhouse of Conservatory Range 2 of The New York Botanical Garden on Saturday afternoon, December 5, 1925.

mentioned, the Golden-Fruited Palm, with golden stems and leaf-stalks. The Wine or Toddy Palm is magnificent in fruit, with beard-like chains of green-purple berries.

Other trees of the tropics are more beautiful than any we have in the North; there are the flaming avenues of Royal Poinciana, or Flamboyant, one of Madagascar's gifts to the plant world, for summer bloom, and the Coral-trees of many kinds, with scarlet and orange flowers in winter and spring. The roadsides and grounds are carpeted with fallen blooms under them and even in the season of no blooms the bark of the trees is strikingly colored, almost pink. Such trees as the mango are decorative as well as fruitful. Of the large trees for shade and flower of gardens the list is being added to constantly. A favorite is the Spathodea or African Tulip-tree, with blazing cluster of red flowers, as large as tulips. Silk-Cotton Tree, West Indian Birch, with its showy bark, Indian Almond, Baobab, Sandbox, Mahogany, Lignum-vitae, Rain-tree, Tamarind, Monkey's-earring, Woman's-tongue, and Bread-fruit are all distinctive trees.

There are roadside gardens in the tropics planted by nature. Here one finds the Horseradish or Ben-tree, of India, with clusters of whitish fragrant flowers nearly the whole year through and the Leucaena, with round heads of white flowers. The scheme she continues along the hedgerows, with introduced vines such as the Black-eye Susan or Thunbergia, yellow, cream or white with rich dark eye, or occasionally the dainty yellow flower and exposed scarlet interior of the fruit of the balsam apple, Momordica.

The tropical forests, luxuriant in themselves, nature makes into gardens by edging them with rose-apples, East Indian flowers with white stamens, which Dr. N. L. Britton says are numerically the most extensive species of plants now in Porto Rico. In the planted gardens flowers are never lacking; fragrance and color are predominant, though foliage is always present. Exotic shrubs of history, such as the Crape Myrtle and Oleander, are always to be found in these gardens. The Chinese Rose or shrubby Hibiscus, with its gorgeous flowers of many shades, is even more popular, fills gardens, lines roadsides, and becomes the subject of the experimenter and the hybridist to a greater extent than most shrubs. There are two colors, red and yellow, in a

glorious flowering relative of the Poinciana, namely, the Barbados Pride. It grows wild, as the beginner says, and blossoms freely on young plants which spring up from seed. The West Indian Yellow Elder, a native shrub, bears golden clusters just as freely. The unique boutonnière, Gardenia, is a happy inhabitant of mountain gardens in the tropics. Its exquisite white blooms are perfect and fragrant.

At lower elevations the Cape Jessamine, found throughout the tropical world, gives rich fragrance from double white blooms. Snow-bush, Aralia, Orange Jessamine, and hundreds of other shrubs furnish foliage and flowers for such gardens. The low herbaceous flowers are too numerous to mention and additional vines, trees and shrubs are being brought into the tropics by plantsmen. Living examples of many sorts from the Garden Conservatories were exhibited at the lecture.

KENNETH R. BOYNTON.

THE BERMUDA ISLANDS[1]

The Bermuda Islands are located about 700 miles from New York City and nearly 600 miles from the nearest land, few islands in the world being more remote so far as their proximity to other bodies of land is concerned. This fact renders them of unusual interest to the student of nature, whether he be geologist, zoologist, or botanist. If you ask a local resident how many islands there are, he will reply promptly 365, one for each day in the year. More conservative persons will tell one this is merely a myth and that there are not nearly so many. If anyone really knows, it is difficult to learn, but it probably depends upon how large a body of rock it takes to make an island. The total land area is about nineteen and one-half square miles and the entire chain of islands is about 20 miles long.

The islands are composed of white limestone, made up of broken shells, corals, and calcareous algae, which have been ground into sand and fused together. The resulting rock is very soft, so that it can be readily cut with a saw and is used for build-

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, May 9, 1926.

ing material. The soil is of a reddish color and not of any great depth. The predominating type of vegetation is the Bermuda cedar, similar to our red cedar but more spreading and of larger growth. The style of architecture is peculiar to this section, the houses being composed entirely of limestone and lumber obtained from the red cedar.

The principal industry is agriculture, Bermuda onions, potatoes and Easter lilies being produced in comparatively large quantities. The islands are becoming more and more a winter resort, so that many of the inhabitants depend upon the tourists for their means of subsistence.

Two visits to the Bermudas were made by the lecturer in the interests of mycology and on the last trip he was accompanied by Professor H. H. Whetzel, of Cornell University, and Mr. Lewcock, of Australia. Mr. Lewcock spent his time making observations on certain fungi parasitic on the "prickly pear cactus," looking toward the possibility of introducing these diseases into Australia to destroy the cactus which has over-run more than sixty million acres of ground there, rendering it useless for agriculture. Professor Whetzel and the lecturer spent their time making a survey of the fungi of the islands. Many new interesting species have been discovered and these will be reported on from time to time in technical scientific papers.

The Bermudians appear to be especially fond of ornamental gardening, the entire section being almost one continuous park. This tendency is accentuated through the activities of several local garden clubs. Abandoned quarries, which are common in the islands and had formerly been used as dumping places, have been cleared out and are being used as quarry gardens. "Quarry gardening" has become quite a fad and the results are very interesting. Because of the prevailing winds the gardens are often inclosed by limestone fences or oleander hedges. No place visited by the lecturer has such a display of beautiful gardens, whether they be associated with the wealthiest mansion or the humblest cottage.

More than one hundred carefully colored lantern slides had been secured for the purpose of illustrating this talk. While Bermuda is a very interesting spot from the scientific point of view,

it is of equal interest to the tourist who wishes to escape from the rigors of a northern winter and spend a few weeks basking in the sunshine of these semi-tropical islands.

FRED J. SEAVER.

THE OLIVIA AND CAROLINE PHELPS STOKES FUND FOR THE PROTECTION OF NATIVE PLANTS

This fund of $3,000, given by the Misses Phelps Stokes in 1901, was the first special endowment of The New York Botanical Garden, its income being restricted to the purpose of the gift.[1] It is, thus, twenty-five years old; it yields an income of nearly $150 a year, the total income during the twenty-five years having been about $3,500. The gift was made for the purposes of investigation and preservation of native plants, or for bringing the need of such preservation before the public.

During the twenty-five years the income has been expended from time to time in various ways. Prizes for essays on the subject were at first offered and the best of them published and widely distributed. Many illustrated lectures have been delivered. Colored illustrations of plants especially needing protection have been made, published, and distributed; some of them have been framed in series and hung on the walls of museums and schoolrooms. Colored lantern-slides have been prepared of many native plants, in flower or in fruit. Correspondence has included many thousand letters.

The operation of this fund has, without doubt, been of great value in restricting the destruction of native plants by indiscriminate picking of wild flowers and the breaking of branches of flowering shrubs and trees. It also led up to the formation in 1902 of the Wild Flower Preservation Society of America, with chapters in many parts of the United States.

The income is at present accumulating for the color-illustration of three or four additional plants needing protection. Those already illustrated are Jack-in-the-Pulpit, Hepatica, Spring Beauty, Wild Pink, Bloodroot, Columbine, Moccasin Flower, Bird's foot Violet, Laurel, Wild Azalea, Rhododendron, Dogwood, and Fringed Gentian.

ELIZABETH G. BRITTON.

[1] See Journal 3: 1, 2. 1902.

WINTER LECTURES AND DEMONSTRATIONS, 1926–27

During the months of December, January, and February, lectures and demonstrations are held in the Central Display Greenhouse of Conservatory Range 2 of The New York Botanical Garden on Saturday afternoons, beginning at three o'clock. The program is as follows:

December 4. "Plants that Produce Rubber." Dr. A. B. Stout.
December 11. "House Plants and their Care." Mr. H. W. Becker.
December 18. "Some Ornamental Plants of the Sea." Dr. Marshall A. Howe.
January 15. "Garden Vegetables and Herbs." Mr. Kenneth R. Boynton.
January 22. "The Spices of Commerce." Dr. H. A. Gleason.
January 29. "Cacti." Dr. John K. Small.
February 5. "Cocoa and Chocolate." Dr. F. J. Seaver.
February 19. "The Planting of Flower Seeds." Mr. George Friedhof.
February 26. "Some Geological Features of The New York Botanical Garden." Dr. Arthur Hollick.

NOTES, NEWS, AND COMMENT

Mr. E. J. Schreiner spent the greater part of the summer in Canada and in Maine in the research on poplars and spruces. He will be located at the Garden for the winter months.

A class in "landscaping the home grounds," under the direction of Professor Hugh Findlay, of Columbia University, has been making numerous visits to the Garden to study trees and shrubs. Mr. Kenneth R. Boynton, Head Gardener, and Mr. Percy Wilson, Associate Curator, have coöperated with Professor Findlay in this course of instruction.

During October, Dr. A. B. Stout, of the Garden staff, spent a week at the State Agricultural Experiment Station at Geneva in obtaining the results of the season's work on the pollination of fruits and in studying the seedling grapes being grown. Later he spent several days in Maine in connection with the research of breeding poplar trees.

First impressions of the display of chrysanthemums shown in the Central Display House, Conservatory Range 2, which contains 50 new varieties originated by Mr. Elmer D. Smith, of Adrian, Michigan, emphasize the great beauty of the new single and anemone varieties and the great extension of the range in flowering time, color, and size of the pot-plant varieties.

The biology classes of the Evander Childs High School, to the number of about five hundred, visited the Garden in the forenoon of Saturday, November 13. After observing certain plants in Conservatory Range 1 and studying trees on the grounds, under the guidance of docents provided by the School and by the Garden, the classes listened to an illustrated lecture on forestry given in the Museum Building by Mr. George T. Hastings, head of the biology department of the Roosevelt High School. A study of some of the economic products of plants in the Museum completed the morning's work.

Dr. Robert Chodat, Professor of Botany in the University of Geneva, Switzerland, spent November 12th and 13th at the Garden, studying the herbarium collections of the Milkwort Family (Polygalaceae), with Dr. Rusby, Dr. Britton, and Dr. Small, with reference to his preparation of a descriptive monograph on this family, to the literature of which he has already made noteworthy contributions. The many novelties recently added to the herbarium through Dr. Small's Florida investigations, the Bolivian collections made by Dr. Rusby, and those from the West Indies and northern South America, obtained on various expeditions, are of especial importance in this connection.

The first conference of the Scientific Staff and Registered Students of the Garden for the autumn was held on the afternoon of November 3rd. Dr. H. A. Gleason spoke on "The ecological survey of Porto Rico." He presented a general summary of the results of this survey, a complete report of which is soon to appear in print as a part of the Scientific Survey of Porto Rico and the Virgin Islands. The ecological survey is one of a series of researches being conducted under the auspices of the New York Academy of Sciences, with the coöperation of the Insular Government of Porto Rico, The New York Botanical Garden, and other institutions. Dr. A. B. Stout reported on "Studies at the

State Agricultural Experiment Station" at Geneva, N. Y. This was a statement of the progress of the studies being made in coöperation with the Department of Horticulture of that institution. A special item of the report was the account of the development of a new seedless grape, which has borne its first fruit this year, and the display of a cluster of the fruit.

This is said to be a wonderful apple year in New York State. Here in the Garden, Crab-apples and Thorn-apples, Choke-berries and Mountain-ash, now that the leaves have fallen, are showy with their red fruits. The American Holly and Winterberries are more heavily fruited than ever before. The various species of *Cornus* and *Viburnum* have been most conspicuous. The Japanese Dogwood, *Benthamia,* with brilliant leaves and pendent fruits, so different from our native Dogwood, has for the first time fruited most abundantly; so has the English Dogwood or Cornelian berry. *Viburnum dilatatum* has kept its cymes of small red berries up to Thanksgiving; birds were feasting the whole autumn on various other species. The Spindle-tree and Burning-bush, species of *Euonymus,* also were most showy, as well as the Bitter-sweet and Virginia Creeper. The Persimmons and the one pistillate Ginkgo tree also bore large crops this year.—E. G. B.

Meteorology for November. The total rainfall at The New York Botanical Garden for the month was 4.57 inches. The maximum temperatures recorded for each week were 62° on the 7th, 65° on the 9th, *66° on the 16th,* and 57° on the 26th. The minimum temperatures were 28° on the 4th, 24.5° on the 12th, 28° on the 22nd, and *21° on the 28th.* A sheet of ice formed on Middle Lake for the first time during the autumn on the night preceding the 28th.

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

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Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

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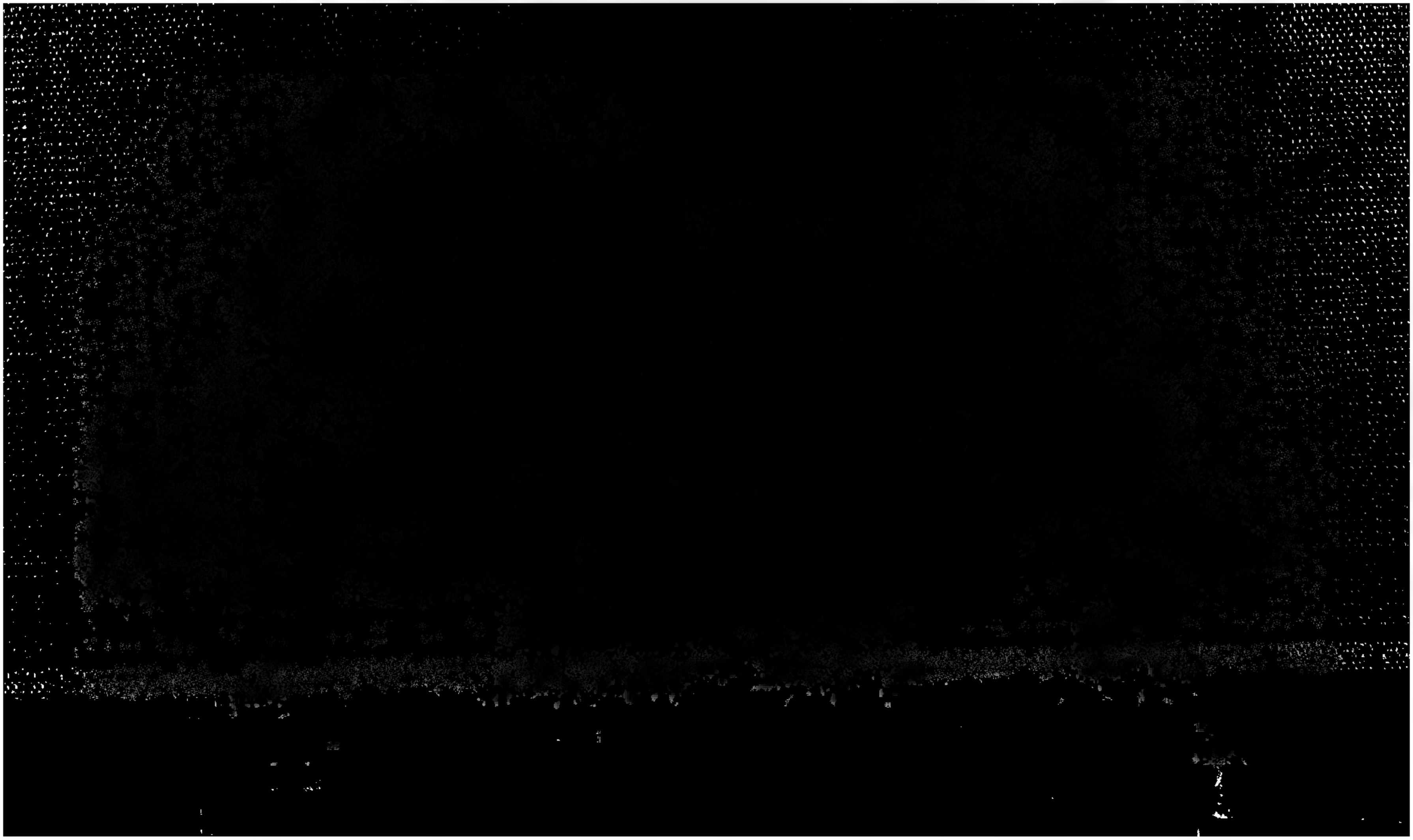

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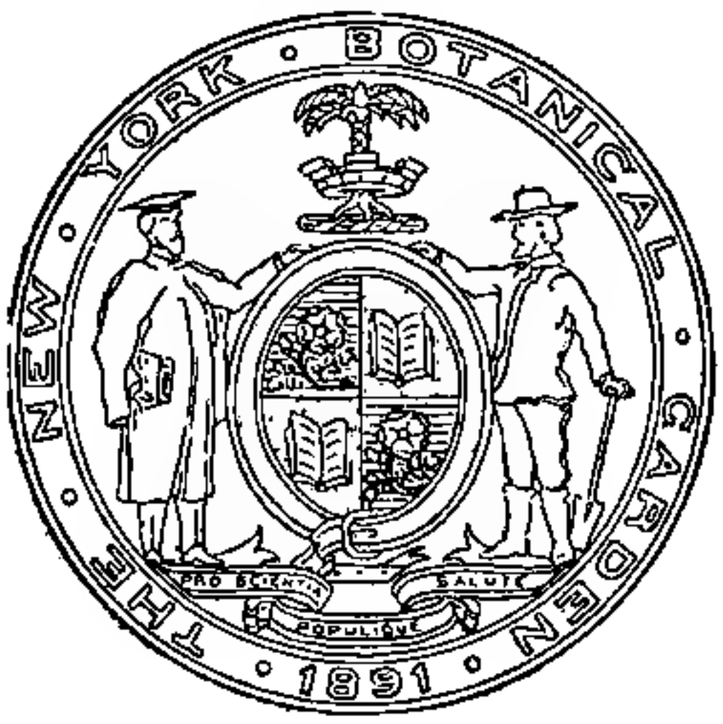

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OF

THE NEW YORK BOTANICAL GARDEN

AMONG FLORAL ABORIGINES

JOHN K. SMALL

A NEW SEEDLESS GRAPE

A. B. STOUT

THE WILLIAM R. SANDS FUND

N. L. BRITTON

NOTES, NEWS, AND COMMENT

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AMONG FLORAL ABORIGINES

A RECORD OF EXPLORATION IN FLORIDA IN THE WINTER OF 1922

The earlier beginnings of economic botany, so to speak, in Florida are prehistoric. The historic records are coincident with the discovery of the peninsula by Ponce de Leon in 1513, but economic botany had long been an important, even a vital, factor in the life and occupations of the aborigines.

In the early Spanish records of the conquest of Florida we meet with much concerning the uses of plants for foods and fibers, as the quotations will show:

"These Indians have no gold, less silver, and less clothing. They go naked, except only some breech-cloths woven of palm, with which the men cover themselves; the women do the like with certain weeds that grow on trees. These appear like wool, although they are different from it." *Fontaneda.*

"As Ponz de Leon passed along the eastern coast of Florida, he inquired the name of the country; . . in the end they answered his importunities by telling him that it was called Cautio —a name that was given to it by the Lucayans, because the inhabitants covered somewhat of their persons with plaited palm-leaves."—*Herrera.*

"The inhabitants make bread of roots, which is their common food the greater part of the years; and because of the lake, which rises in some seasons so high that the roots cannot be reached in consequence of the water, they are for some time without eating this bread. . . There is another root like the truffle of this country which is sweet."—*Fontaneda.*

"The men go naked, and the women in a short cloak made of a kind of palm-leaf, split and woven."—*Fontaneda.*

"They make bread from certain roots, such as I have described before as growing in swamps."—*Fontaneda.*

"These Indians do not wear clothing, not even the women. They go naked, except some dressed deer-skins made into breech-cloths. . The females cover themselves about the waist with straw that grows on trees. This weed is like tow, or wool, but is brown, instead of white."—*Fontaneda.*

"All the people of this country go naked; only the women cover part of their bodies with a kind of wool that grows on trees."—*de Vaca.*

"They also drink something which they extract from leaves of trees, . . . toasting them on the fire in a vessel like a low-necked bottle."—*de Vaca.*

"After which time they would remove to another section in order to eat prickly-pears. For three months they subsist upon them exclusively, eating nothing else."—*de Vaca.*

Thus we find cycads (*Zamia*), palms (*Thrinax, Coccothrinax, Sabal, Serenoa, Paurotis, Rhapidophyllum, Roystonea*), Florida-moss (*Dendropogon*), green-brier (*Smilax*), ground-nut (*Glycine*), cassena (*Ilex*), and tunas or prickly-pears (*Opuntia*) mentioned more or less definitely, and also "fruits of different kinds which to mention would be endless."

These records are intensely interesting, even fascinating, in the light of our recent botanical explorations in Florida and our studies in the very groups of plants so extensively used by the aborigines. Furthermore, our work on the kitchen-middens and their floristics, mentioned in this and in former articles,[1] lend an interest quite as great to a quotation from Alvar Nuñez Cabeza de Vaca's record of his celebrated journey (translation of Ad. F. Bandelier, page 68), regarding the origin and uses of these artificial shell-mounds:

"Therefore the Indians by whom I was kept forsook the Island and in several canoes went over to the mainland to some bays where there were a great many oysters, and during three months of the year they do not eat anything else and drink very bad water. . . . Their lodges are made of matting and built on oyster-shells, upon which they sleep in hides."

Curiously enough, it is these same economic plants of the pre-Columbian period and the middens that brave de Vaca mentions that most engross us in this modern day.

Before proceeding to a detailed account of our most recent field-work in Florida, however, and also many incidental studies

[1] Journal of The New York Botanical Garden **26**: 265–266. 1925.

in the Deering reservations in the Miami region, we beg to acknowledge that these were all a result of the personal interest of Mr. Charles Deering himself in the vegetation of Florida.

THE EASTERN COAST REGION

Our first long journey, after taking the field, extended from the mouth of the Miami River to the mouth of the Saint John's. The localities visited were mostly in the immediate vicinity of the coastwise lagoons—the larger ones being Bay Biscayne, New River Sound, Hobe Sound, Saint Lucie Sound, Indian River, Banana River, Mosquito Lagoon, and Halifax River, and various marshes and prairies that were evidently lagoons in former times.

Bloom in general was at low ebb. However, stray plants or colonies here and there, for one reason or another, showed flowers even when most of the vegetation was dormant. Here and there in the high pinewoods the yellow heads of the tick-seed (*Coreopsis Leavenworthii*) would appear; in the low pinewoods the two fleshy plants—the white-flowered lance-head (*Sagittaria lancifolia*) and the purple-flowered wampee (*Pontederia cordata*) were not rare. Between the coastal pine-strip and the Everglade pine-strip, the prairies—once doubtless lagoons—supported rather coarse vegetation, prominent among which was the dog-fennel (*Eupatorium capillifolium*), groundsel-bush (*Baccharis glomeruliflora*) and flaveria (*Flaveria linearis*). We visited the locality, west of Hallandale, where two Texano-Mexican cacti are naturalized. These exotic species—one a snake-cactus (*Selenicereus coniflorus*), the other a prickly-pear (*Opuntia Lindheimeri*)—still held their own and were spreading over more ground. Incidentally our first diamond-back rattlesnake came out from the great clump of prickly-pear, but a machete soon rendered him harmless. As a result of the rainy season, ditches along and in the prairies were lined by or hidden by great masses of feathery wood-fern (*Dryopteris normalis*). Farther north, in the high coastwise pinelands, a golden-aster (*Chrysopsis Tracyi*) and a large purple-thistle (*Cirsium Smallii*) were seen occasionally, while, in the flat "scrub," yellow-buttons (*Actinospermum angustifolium*) and wire-weed (*Delopyrum ciliatum*) were in flower.

The hammocks along streams that carry the Everglade water to the sea were nearly flowerless, but the beautiful Carolina-aster

(*Aster carolinensis*) saved the day and showed hundreds of purple starry heads on the stems that clambered over the cypress-knees and trunks. Toward the settlement of Boca Ratone we found large areas of pineland with the naturalized exotic rattle-box (*Crotalaria striata*) which grew just as we had found it several years before further north in the peninsula. That decorative garden spot, the high sand-dunes between Del Ray and Palm Beach, was green, but devoid of more decided colors, except for the yellow beach-sunflower (*Helianthus debilis*) and the tropical purple morning-glory (*Ipomoea cathartica*).

The sand embankments of the aboriginal rectangular fortification which is situated between four and five miles north of West Palm Beach, originally extending from near the lagoon—Lake Worth—back into the scrub, are fast disappearing. Unfortunately, a settlement has been established in it, and thus the most interesting aboriginal monuments of Florida are becoming things of the past. South of this region the scrub is mostly flat. Areas miles in extent are almost without an evident undulation. When cleared of vegetation the natural level seems almost incredible. Northward the sands of the scrub begin to undulate, rise into mounds, and form hills which finally reach nearly a hundred feet altitude with interspersed lakelets—a miniature of the lake region. Some scrub-inhabiting plants thrive best in the level parts, others in the hilly parts. Here two characteristically winter-flowering plants became evident. The one, plume-knotweed (*Thysanella robusta*) of the buckwheat family, grew in large clumps and bore myriads of white or pink plumes; the other, a golden aster (*Chrysopsis gigantea*), bore myriads of yellow flower-heads. Yellow dominates the green in the stems and leaves of this plant and curiously enough the leaves on the lower half of the stem die at anthesis and turn black. In the marshy places, where small specimens of the pond-cypress (*Taxodium ascendens*) often grew, there frequently were large colonies of "lilies"—*Thalia divaricata*—usually a disorderly looking plant, for the leaves seem to have no decided position and the tall flower-stems standing at all angles are terminated by a scraggly inflorescence. Associated with *Thalia* was a reed-like plume-grass (*Erianthus*) whose almost spent spear-like stems, reaching twice as high as one's head, were almost ready to fall. After the sun had set, the white saw-pal-

metto (*Serenoa repens*), so characteristic of the "scrub," was very prominent against the deep green rosemary (*Ceratiola*), the spruce-pine (*Pinus*), and the scrub-oaks (*Quercus*), as a background.

After a night at Fort Pierce we continued northward. The scrub continued to parallel the lagoon and marshes, but it was much less extensive and lower in altitude than in the Hobe Sound region. Like other geologic formations these old dunes support a vegetation varying in interest and complexity. We happened on an area of scrub south of the mouth of the Sebastian River, with a remarkably prolific plant covering. Near the shore of the Indian River, apparently on an aboriginal village site, for the inevitable village-site prickly-pear (*Opuntia stricta*) is there, stands a hammock of tropical trees and shrubs. More than two dozen tropical woody-plant elements are present, mostly berry-bearing plants. The more conspicuous arboreous elements were:

Ocotea Catesbyana
Sideroxylon mastichodendron
Icacorea paniculata
Zanthoxylum Fagara
Rhamnidium ferreum
Elaphrium Simaruba
Eugenia axillaris
Ximenia americana
Chrysophyllum olivaeforme
Torrubia longifolia

Some of the shrubs and trees were merely in leaf, others were in flower, and yet others were in fruit. Of particular interest was *Randia* which occurred there as a small tree.[2] Temperate plants were not wanting in this tropical assemblage, for the hickory (*Hicoria*), wild-olive (*Osmanthus*), and holly (*Ilex*), were in evidence. Westward from the lagoon, there was often a mixed growth of spruce-pine (*Pinus clausa*) and live-oak (*Quercus virginiana*) instead of the normal scrub-association. The ground was covered with a red carpet of dead pine-needles. However, this carpet was often hidden beneath a quite astonishing growth of lichens. There were three grades and kinds of conspicuous

[2] Journal of The New York Botanical Garden **23**: 154. 1922.

FIGURE 1. On scrub ridge along Sebastian River near its mouth where acres of the reindeer-mosses (*Cladonia leporina, C. rangiferina,* and *C. rangiferina minor*) cover the white sand like snow. The woody growth consists of spruce-pine, saw-palmetto, and cabbage-tree. Here the cowhorn-orchid grows on the cabbage trees, a hundred miles north of its usual range. A frequent associate of the reindeer moss is Britton's Indian pipe (see FIGURE 2), which often

lichens fine, medium, and coarse in texture. Botanically, they were *Cladonia leporina, C. rangiferina,* and *C. rangiferina minor,* or in common parlance, reindeer-moss (FIGURE 1). The one of a fine texture was almost snow-white; the coarse one was a grayish-white. Either specifically pure or more or less mixed, the lichens often covered large areas with uninterrupted patches. The growth was so dense that nearly all herbaceous growth was smothered, except the southern Indian-pipe (*Monotropa Brittonii*),[3] which pushed through as individuals or as colonies, with its cream-colored or salmon nodding flowers and black dead ripe erect capsules (FIGURE 2). This locality is over one hundred miles north of that where this Indian-pipe was discovered several years ago.[4] An occasional cabbage-tree appeared among the pines and live-oaks, and much to our surprise it was found to be the host of the tropical butterfly-orchid (*Cyrtopodium punctatum*). This discovery adds about one hundred and fifty miles to the northern extension of this orchid's geographic range.

There is a kitchen-midden on the north side of the estuary of the Sebastian River, as well as on the south. Many of the shrubs and trees that were found on the south side were also present on the north. In addition we noticed:

Fiddle-wood (*Citharexylum frutescens*)
Naked-stopper (*Anamomis Simpsonii*)
Coral-bean (*Erythrina arborea*)
Twin live-oak (*Quercus geminata*)

The further north we went the more plentiful the naked-stopper became, until it reached its climax in the Halifax River region.

[3] **Monotropa Brittonii** Small, sp. nov. Plant mostly 1.5–4 dm. tall, decidedly tinged with yellow, especially above, the stems solitary or in dense colonies: leaves colored like the stem: flowers nodding, ochroleucous or salmon-colored: sepals cuneate-spatulate, 1.5–2 cm. long: petals about as long as the sepals or slightly longer, copiously ciliate: filaments pubescent with long hairs, usually copiously so: capsule ellipsoid-ovoid, with a rather short neck.—In scrub, southern peninsular Florida. Winter, but with a scattering growth at other seasons. —Differs from *M. uniflora* in the broader leaves; larger flower; ciliate sepals and petals, which are only shallowly saccate at the base; copiously pubescent filaments; and larger capsule, which is 1.5–2 cm. long.

[4] Journal of The New York Botanical Garden 22: 201. 1921.

FIGURE 2. Small colony of Britton's Indian-pipe (*Monotropa Brittonii*) from type locality in the scrub north of Pompono, Florida. (See foot note on another page.) The plants are shown about two-thirds natural size. The colony was dug up to show the mass of roots and white sand. Leaves of the spruce pine may be seen mixed in the clump. The stem, leaves, and flower are greenish-yellow or ochroleucous.

The life-plant (*Bryophyllum*) and the bow-string hemp (*Cordyline*), so commonly naturalized in the hammock along Saint Lucie Sound, were noticed at many points along the rest of the Indian River. Kitchen-middens of various sizes, as well as aboriginal village sites, were found along all the creeks that empty into the coastwise lagoons. It has been said that "history repeats itself" and these old village sites proved it, for in a number of cases the motor tourists had selected these same aboriginal village-sites for camping places in their travels up and down the coast.

The southern end of Merritt's Island and vicinity was our next objective. This locality is a fertile field for exploration and study. In traveling southward from the bridge, which crosses the lagoon at Cocoa, we passed two large kitchen-middens. One is at the settlement called Fairyland, while the other is at Horti Point. Both of these mounds are on the Banana River side of the island. We drove to the end of the road at Tropic. About two more miles by row-boat took us to the southern tip of the island, where the Banana River and Indian River meet. Just eastward from this junction is a large kitchen-midden. It is along the western shore of the coastal sand-dunes, facing the Banana River. It extends fully an eighth of a mile along the water and rises to twenty-five or thirty feet in height. The shells are for the most part of small kinds. A burial mound lies to the eastward. This is about two hundred and fifty feet in diameter and fifteen to twenty feet high.

The woody vegetation of the midden is composed of:

Satin-leaf (*Chrysophyllum olivaeforme*)
Gumbo-limbo (*Elaphrium Simaruba*)
Snowberry (*Chiococca alba*)
Ironwood (*Rhamnidium ferreum*)
Lancewood (*Ocotea Catesbyana*)
Wild-lime (*Zanthoxylum Fagara*)
Strangling-fig (*Ficus aurea*)
Naked-stopper (*Anamomis Simpsonii*)
Spanish-stopper (*Eugenia buxifolia*)
White-stopper (*Eugenia axillaris*)
Torchwood (*Amyris elemifera*)

Wild-coffee (*Psychotria undata*)
Mastic (*Sideroxylon mastichodendron*)
Devil's-claws (*Pisonia aculeata*)
Dune-bay (*Tamala littoralis*)
Pigeon-plum (*Coccolobis laurifolia*)
Tallow-wood (*Ximenia americana*)
Whitewood (*Schoeffia chrysophylloides*)
Marlberry (*Icacorea paniculata*)
Cassena (*Ilex Cassine*)
Indigo-berry (*Randia aculeata*)
Paradise-tree (*Simarouba glauca*)
Butterbough (*Exothea paniculata*)
Soapberry (*Sapindus Saponaria*)
Caper tree (*Capparis cynophallophora*)
Papaya (*Carica Papaya*)
Gouania (*Gouania lupuloides*)

Herbaceous plants were few in kind. The tropical morning-glory (*Ipomoea cathartica*), poor-man's patches (*Mentzelia floridana*), coral-berry (*Rivina humilis*), and heliotrope (*Heliotropium parviflorum*) were widely distributed.

It will be noticed that the above-mentioned plant-association is almost without exception comprised of tropical species, which flourish there in spite of cold spells, as a result of the blanket of warm air which is radiated from the stored up interior heat in the spaces between the shells of the mound.

In this connection the burial mound is of particular interest. Although it is almost adjacent to the midden, its vegetation is of an entirely different character, mainly:

Scrub-oak (*Quercus myrtifolia*)
Live-oak (*Quercus virginiana*)
Red-bay (*Tamala Borbonia*)
Cabbage-tree (*Sabal Palmetto*)
French mulberry (*Callicarpa americana*)

A mere glance at these two lists will show the vast difference in the amount of latent heat-energy in the two kinds of mounds, shell on the one hand, sand on the other.

Now, passing from this artificial and very recent shell formation, geologically speaking, we recrossed the Banana River for a

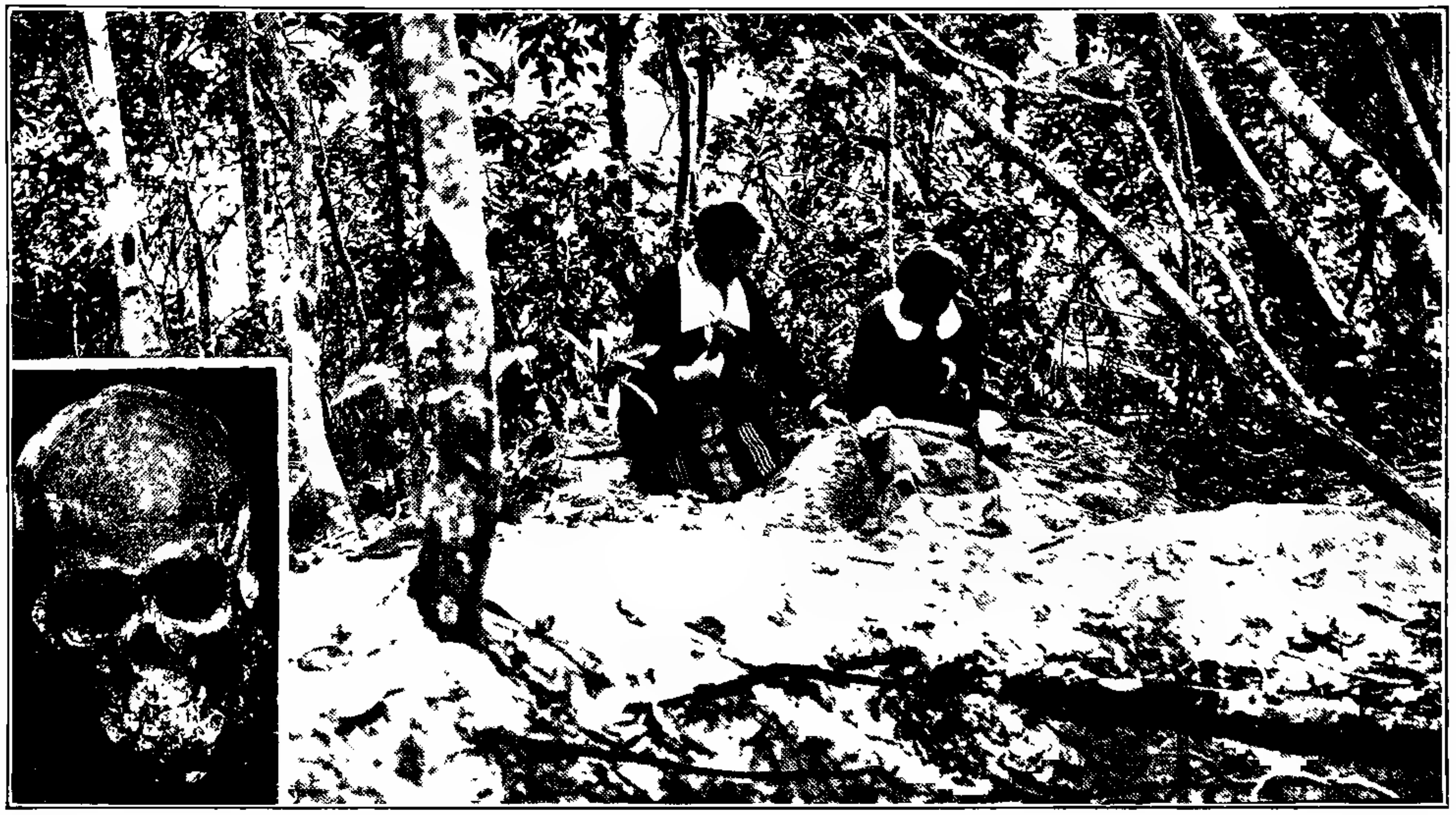

FIGURE 3. An aboriginal burial mound in mangrove-swamp along Indian Creek opposite Arch Creek, Florida. Several centuries of weathering had brought numerous skeletons near the surface. Most of the skulls indicated death by violence—being pierced or fractured The insert shows a skull of a member of this now extinct tribe The village site, a triangular plateau built up in the mangroves, lay to the right or south of the mound. Besides shell instruments as evidences of occupation were very old red-mulberry trees, one of the economic plants of the Indian. The trees and shrubs of the mound and village site are berry bearers and thus are foreign to the mangrove-swamp. They were probably brought there by birds.

few observations on an older and natural geologic shell formation —the coquina rock of the southern tip of Merritt's Island. The flora and floristics of this coquina were quite distinct from that of the kitchen-midden mentioned above.

This knife-like spit of coquina, varying from ten to fifteen feet in height, has been and is now being worn away—honeycombed, undermined, and tunneled—by the continuous lapping of the waves of surrounding waters.

At the water's edge several salt-loving trees flourish for the time being, awaiting their turn to succumb when the waves will have washed away their precarious foothold. The mangroves—red-mangrove (*Rhizophora Mangle*), white-mangrove (*Laguncularia racemosa*), black-mangrove (*Avicennia nitida*), and button-mangrove (*Conocarpus erecta*) -constituted the bulk of the water line trees. A sea-grape (*Coccolobis Uvifera*) and a blolly (*Torrubia globularis*) were occasionally in evidence.

The rock formation resulting from the continuous erosion is rugged and sharp. As if in keeping with this rugged environment, the vegetation is stocky and spiny. Such tropical hammock trees as are duplicated from the nearby kitchen-midden described above, are stunted and rigid in habit.[5] The spiny character of the vegetation was evident, even as viewed from the water. Not fewer than ten armed species of woody plants form this conspicuous bristly association. Arranged in systematic sequence, they are: century plants (*Agave decipiens, A. neglecta*), Spanish-bayonet (*Yucca aloifolia*), wild-lime (*Zanthoxylum Fagara*), prickly-pears (*Opuntia Dillenii, O. stricta, O. cumulicola*), dildoe (*Acanthocereus floridanus*), prickly-apple (*Harrisia fragrans*), saffron-plum (*Bumelia angustifolia*), indigoberry (*Randia aculeata*). Of course, century-plants, Spanish-bayonets, and cacti emphasized the desert-like effect of the vegetation. The fruits of the cacti broke the monotony of the otherwise almost universal green of the vegetation. The purple-red of the prickly-pears, the dull-red of the prickly-apples, and the bright scarlet of the dildoe against the green of the cactus stems presented a welcome relief in the panorama as we rowed along the shore. The setting sun and the advent of a norther with rain prevented further studies in the flora of this unique locality.

[5] A complete list will be printed in a future article.

We drove on to Daytona in the night. The rain continued, but in spite of it we were able to go a little further with our studies on the larger shell-middens down toward Mosquito Inlet—Two-house mound, Castle-mound, and Green-mound. We located the accompanying burial mounds of each of these shell mounds. The floras of the burial mounds were quite different from those of the kitchen-middens, as was described in the case of the large middens east of the southern tip of Merritt's Island.

One noteworthy feature of each mound may be mentioned here:

Two-house mound had developed a copious growth of the ebony-spleenwort (*Asplenium platyneuron*). In the dense part of the hammock this fern in abbreviated form often covered the humus in large mats. On account of the rain, it, as well as the resurrection fern (*Polypodium polypodioides*), showed to very good advantage.

On Castle-mound, where the top layer of shells, together with the accumulated humus had been removed, especially about the one-time fireplace, a miniature forest of white-stopper (*Eugenia axillaris*) had sprung up. The trees, if so they may be called, were about one foot high and were in full fruit.

On the slopes of Green-mound, in the dense shade of the scrubby-vegetation, we found patches of the wild-pepper (*Peperomia cumulicola*). This discovery marks the first collection of this plant on the coastwise kitchen-middens of the Halifax River. It is very abundant on the middens of the nearby mainland.

The temperature, as well as the rain, continued to fall, and before we reached Jacksonville the weather was uncomfortably cool, as well as very wet. The following two mornings were ushered in with hoar-frost.

A DETOUR TO THE WESTERN COAST

At Jacksonville we were reinforced, for a ten-day excursion, by Kathryn W. Small and Florence M. Fitzpatrick. The norther continued, so we promptly headed southward. A proposed examination of the plant-association of the Matanzas River was frustrated by high water in the low country south of Saint Au-

FIGURE 4. On sandhills along Lake Nancessowee (Lake Jackson), near Sebring, Florida. The type colony, consisting of several small trees of *Ilex cumulicola* discovered on Christmas morning, 1922. This decorative holly, related to *Ilex opaca,* grows on the sand hills of the Lake Region, increasing in abundance toward the southern end on the vast rolling desert-like hills north of the Indian Prairie. The deep-green foliage and red fruits are in strong contrast to the snowy sands.

gustine. Likewise our proposed section of country over the King's Road[6] instead of the "Dixie Highway" had to be deferred. However, we drove southward on the King's Road into the "scrub" where the spruce-pine is taller than usual. An unusual sight presented itself here. The pine-trees had dropped many leaves, sufficient to cover the ground. In their process of decay, and partly as a result of the wet weather, they had assumed a bright brick-red color, so that acres of the level white sand were hidden beneath an unbroken red carpet which contrasted conspicuously with the uniform evergreen foliage above.

We used the Dixie Highway as a detour and met the King's Road where it runs into the Dixie Highway near Ocean City. The weather was cold and rainy, but on reaching the vast dunes, which we traversed from Ocean City southward to the Iron Bridge, a decided rise in temperature was evident. However, although vegetation was green everywhere, flowers were scarce. Two yellow flowers were in evidence, Saint Peter's-wort (*Ascyrum tetrapetalum*) and partridge-pea (*Chamaecrista fasciculata*). On some areas the saw-palmetto (*Serenoa repens*) held undisputed sway, but frequently it gave way to the scrub-oaks and associated woody plants, which with their brush-like, wind-pruned tops, sloping from the ocean, presented various shades of green—gray-green of the live-oaks to deep-green of the myrtle oak—and an occasional dash of brown where the dead oak leaves persisted on the bushes.

The growth is even and natural except where an intruder, so to speak, has asserted itself. For example, a lost pine tree, as it seems, from a seed blown over from the pinewoods on the western side of the lagoon, or a guava-bush, perhaps from seeds planted there by a bird, or a wild orange tree, a descendant from ancestors planted in the neighborhood by the early Spanish settlers or by the later immigrants from the northern states.

Frosts rendered collecting rather a secondary occupation, so we hastened to cross the peninsula by the shortest route to Crystal River. There we made further studies of the flora of the shell mound—Gulf Breeze Island—at the mouth of Crystal River. We made further studies in the zamias that grow there and procured

[6] Journal of The New York Botanical Garden **26**: 283. 1925.

ripe seeds for growing them for study in the conservatories at the Garden. We also secured a number of the roots of the aboriginal morning-glory (*Ipomoea macrorhiza*?) for growing and for museum specimens. These roots, doubtless one of the food plants of the aborigines, vary greatly in size. The largest one we secured weighed fifty-two pounds several months after it was taken from the ground.

Other kitchen-middens in the Crystal River region are situated as follows:

Spanish-mound on the northern side of the river, two and a half miles from the town of Crystal River.

Mound on the south side of Crystal River about four miles below the town.

Mound about a mile up Coney Creek, two and a half miles north of Crystal River.

Mound at Black Point, one and a half miles north of the mouth of Crystal River.

Several mounds (one called Pumpkin Island) at the mouth of the Withlacoochee River.

Mound on Chair Island in Salt River near Crystal River.

Eight mounds in the upper (southern) reaches of Salt River.

Mound on Mullet Key, three miles south of the mouth of Crystal River.

Several mounds along the Homosassa River and at its mouth.

A dozen mounds or more at Saint Martin's River.

The flora of some of these mounds has already been discussed.[7] We hope to study those not yet visited in the near future.

In addition to these middens, there are several burial mounds in that region. One along the Withlacoochee River was described in a former article.[8] On this occasion we visited two burial mounds. One of these is in the pinewoods about two miles north of Crystal River between the main highway and the Gulf of Mexico. Its flora did not differ from that of the surrounding pinewoods. The only large trees on it were long-leaf pines. We went to a burial mound which is in a dense hammock about three and a half miles southwest of Crystal River. In the case of the

[7] Journal of The New York Botanical Garden **25**: 62–64. 1924.
[8] Journal of The New York Botanical Garden **25**: 63. 1924.

mound in the pinewoods, sand alone enters into its structure. This hammock mound is made up of dirt brought from various places, for we find in it layers of *whitish, gray, yellow, red,* and *black* earth. Its surface is well covered with woody vegetation—cabbage-tree (*Sabal*), hickory (*Hicoria*), bull-bay and sweet-bay (*Magnolia*), live-oak and water-oak (*Quercus*), red-bay (*Tamala*), red-cedar (*Sabina*), and cassena (*Ilex*).

Time allowed for collecting at points in the western coast region was otherwise consumed as a result of a minor accident to our motor. Consequently we set out towards the southern part of the lake region, and some exceedingly interesting country had to be traversed at night. In the detour around the unsettled country between Homosassa and Aripeka we reached Brooksville after dark and left it for the Gulf coast before dawn. The clear frosty air and a cloudless sky gave us a wonderful view of the heavens. About five o'clock, before dawn, there were two " morning stars " —the planets Venus and Mercury. The contrast of their colors was striking, Venus of a bluish-white, almost dazzling, and Mercury of a bright orange.

Dawn and our advent on the Gulf coast were coincident. There, in the scrub near the water, only one shrub, a heath (*Xolisma fruticosa*), and one herb, a wire-weed (*Delopyrum ciliatum*), were found in flower. The typical scrub shrub *Garberia* —bore myriads of feathery heads of fruits.

Near Clearwater we turned eastward to cross over to the lake region. A long stretch of flatwoods confronted us. The season of the year naturally had eliminated all the showy flowering plants from the pinewoods. The contrasting plant associations—the elder thickets, cypress-swamps, sweet-bay hammocks, black-jack ridges—one and all, were inviting spots for investigation as we passed by. After crossing the isthmus of the Pinellas peninsula, our proximity to salt water—the head of Old Tampa Bay—was indicated by two salt-loving vines growing in the pinewoods. The one a sea-bean (*Canavali lineata*), the other a morning-glory (*Ipomoea Pes-Capri*). As soon as we passed into the lake region east of Bartow, the desert-like scrub began to show flowers. The temperature of the scrub is, on good authority, said to be lower than that of the flatwoods, yet, in winter as well as in summer, it is more floriferous. At this time—December 24th -when the

pinewoods were nearly or quite without flowers, the scrub abounded in the sky-blue lupine (*Lupinus cumulicola*), plumed-knotweed (*Thysanella robusta*), fly-catcher (*Befaria racemosa*), and several woody heaths, among which the fetter-bush (*Desmothamnus lucidus*), with its white and pink flowers was the most conspicuous. Occasional bushes of the dog-banana (*Asimina obovata*), with its large nodding flowers and garberia (*Garberia fruticosa*), with its rose-purple heads were not rare. We drove down the back-bone of the lake region, and from the tops of the ridges various lakes and groups of lakes passed in view. Not only were the lakes blue or indigo, but the distant pine-clad hills and ridges appeared in paler tints of the same colors.

A study of the floristics of these myriad lakes is a fascinating problem awaiting attack. Viewed from the hills some lakes were framed merely in the white sand of the beach, others in a sweet-bay hammock, others with lily-pads, others with maiden-cane, others with cypress, others with St. John's-wort, and so the list might be continued. The aquatic vegetation is almost unknown; the possibilities of novelty among the aquatic flowerless plants is indicated by the discovery, a few years ago, of a new species of quillwort (*Isoetes*) in lakes at Riverland.

Christmas morning found us in the southern end of the lake region, where the soil would appear to be incapable of supporting vegetation, but where we actually find greater variety than elsewhere. We confined our activities to the vicinity of Lake Nancessowee (Lake Jackson).

The frosts prevalent in the northern parts of the peninsula had not reached this region. In the low places near the lake clumps of goldenrod (*Solidago fistulosa*) and broom-grass (*Andropogon virginicus*) stood over ten feet tall.

On the arid sandhills, vegetation flourished –flowering and fruiting regardless of the winter season. There were no dormant shrubs or trees in evidence. Moreover, a dozen species of woody plants were in flower and in fruit at the same time. Among these were the spruce-pine (*Pinus clausa*), two green-briers (*Smilax laurifolia, S. Beyrichii*), rosemary (*Ceratiola ericoides*), dahoon (*Ilex Cassine*), red-bay (*Tamala pubescens*), fetterbush (*Desmothamnus lucidus*). Two or three of these woody plants appeared here in forms different from those found elsewhere in the

state. A dozen kinds of herbs could be easily gathered. However, those most in evidence on the snow-white sand were three kinds of the knotweed family and two of the pinweed family.

As we were about to start for the eastern coast, we spied a quite distinctive looking shrub or small tree up on one of the sandhills. Upon investigation it proved to be a new spiny-leaved holly—a decorative holly, since described as *Ilex cumulicula,* so named for its habitat on the sandhills. It was not only a new species, but another species in America related to the American-holly (*Ilex opaca*), which is so extensively used during the Christmas season and thus in danger of becoming extinct. We were well satisfied with this finish of our half day in these sandhills. Before we left, however, we found new localities for our smallest kind of plum--*Prunus geminata.* The shrubs were nearly defoliated, but the leaf-buds and flower-buds for the coming spring –February or March were prominently developed.

As we proceeded eastward, we found the Istokpoga Prairie clothed with rich green vegetation—the result of the heavy rains of the preceding summer and fall. Saw-palmetto (*Serenoa repens*) is the only prominent plant there, that is, the only one large enough to eclipse the others. Relatively, though, it is not large, but it is evenly and extensively distributed.

The Okeechobee Prairie, separated from the Istokpoga Prairie by the Kissimmee River and its prairies, has a more varied prominent plant covering. The saw-palmetto there is much larger; there are large areas covered with flags (*Iris*) and other areas with switch-grass (*Spartina*). Then there are cabbage-tree oases which harbor herbs and shrubs that do not otherwise grow on the prairie proper. In addition there is an occasional pine tree or a clump of pines which have sprung up from seeds blown there from the distant pinelands, which often appear on the horizon as a blue line. Of course, there are enough pine-trees and cabbage-trees around and on the prairies to forest the whole prairie-area, but for some reason those trees will grow to maturity only on the few spots where we now find them.

We drove down the prairie to the head of Lake Okeechobee. There we beheld a rare sight -the lake basin brim full and even overflowing. This season was the first that the lake was full of water in nearly a decade. For several years past, on our explor-

ing trips, we have been driving our car for miles over the former bottom of the lake, often several miles from the old shore-line. Furthermore, we had witnessed the wanton destruction of the gigantic humus-deposit of the Okeechobee basin—perhaps the largest in North America –and its unique hammock formation primarily by FIRE! The destruction of these works of ages in less than a decade is one of the several major crimes in the Florida Commonwealth. These crimes may be summed up in the words: DRAINAGE; FIRE; DESTRUCTION OF NATURE'S MONUMENTS; DESTRUCTION OF ABORIGINAL MONUMENTS. DRAINAGE AND FIRE are fast turning the Florida peninsula back to the desert it was when last elevated above the sea!

JOHN K. SMALL.

(*To be continued*)

A NEW SEEDLESS GRAPE

It may be reported that a new seedless grape has been obtained which gives promise of value for culture in New York State. This plant is one among the first of the seedlings grown in the effort to develop new and hardy varieties of seedless grapes -a project in which the writer, representing The New York Botanical Garden, has coöperated with the Department of Horticulture of the New York Agricultural Experiment Station at Geneva.

The fruit of this grape rather closely resembles that of the Thompson Seedless or Sultanina. The color of the berries is greenish yellow or a shade of pale yellow when fully or over ripe, the flavor is sweet and vinous but not strongly flavored, and the pulp is meaty and tender. The fruit is, therefore, quite decidedly *vinifera* in character. No seeds were found in any of the berries of the several clusters produced by the plant. Only soft rudimentary seeds were present, as is the case with various seedless grapes. The berries are oval and small but of good size for a seedless grape. The largest of the clusters borne this first year of fruiting weighed slightly over eight ounces and measured eight inches in length. The accompanying photograph with scale in

inches will give an idea of the size of this cluster and of its berries.

This seedling is a result of a deliberate attempt to produce hardy seedless grapes by methods of breeding outlined in a bulletin[1] issued by the State Experiment Station and also in a former number of this JOURNAL.[2] It is a seedling from a cross between a "near-seedless" plant as a seed parent and the variety Rose Sultanina as a pollen parent.

The seed parent is a seedling reared at the Experiment Station and derived from the cross Triumph x Dutchess. It has been fully hardy, living through several winters without protection. Its berries are white, sweet, and of the "slip-skin" type and a part of them contain one seed each and occasionally two seeds are found in a berry.

The pollen parent is the Rose Sultanina, a color variation (probably a bud-sport) of the well-known seedless grape long cultivated in the Mediterranean countries and in the Levant and more recently in California under the names Sultanina and Thompson Seedless. The Sultanina grape furnishes the greater proportion of the seedless raisins of commerce and in recent years it is being sold rather generally in the markets of eastern United States as a fresh table fruit. The Sultanina and the Rose Sultanina are of the *vinifera* type of grape and are too tender for general outdoor culture in New York State. Although the fruits are said to be perfectly seedless, the flowers produce an abundance of good pollen. They may, therefore, readily be used as a pollen parent in cross-breeding on seeded or near-seedless sorts.

It has not been an easy matter to secure pollen of the *vinifera* seedless grapes (Sultanina, Black Monukka, etc.) for use in the breeding work at Geneva. In the several years of this work to date it has been possible to cross a near-seedless plant with a *vinifera* seedless variety but once. Thirty seeds were obtained, but of the seedlings only two lived to blooming age. One has

[1] Types of flowers and intersexes in grapes with reference to fruit development. Technical Bulletin No. 82. N. Y. Agric. Exp. Station. 1921. By A. B. Stout. Contribution No. 231 from The New York Botanical Garden.

[2] Studies of grapes in coöperation with the State Experiment Station at Geneva, N. Y. Jour. N. Y. Bot. Gard. **22**: 148–156. 1921. By A. B. Stout.

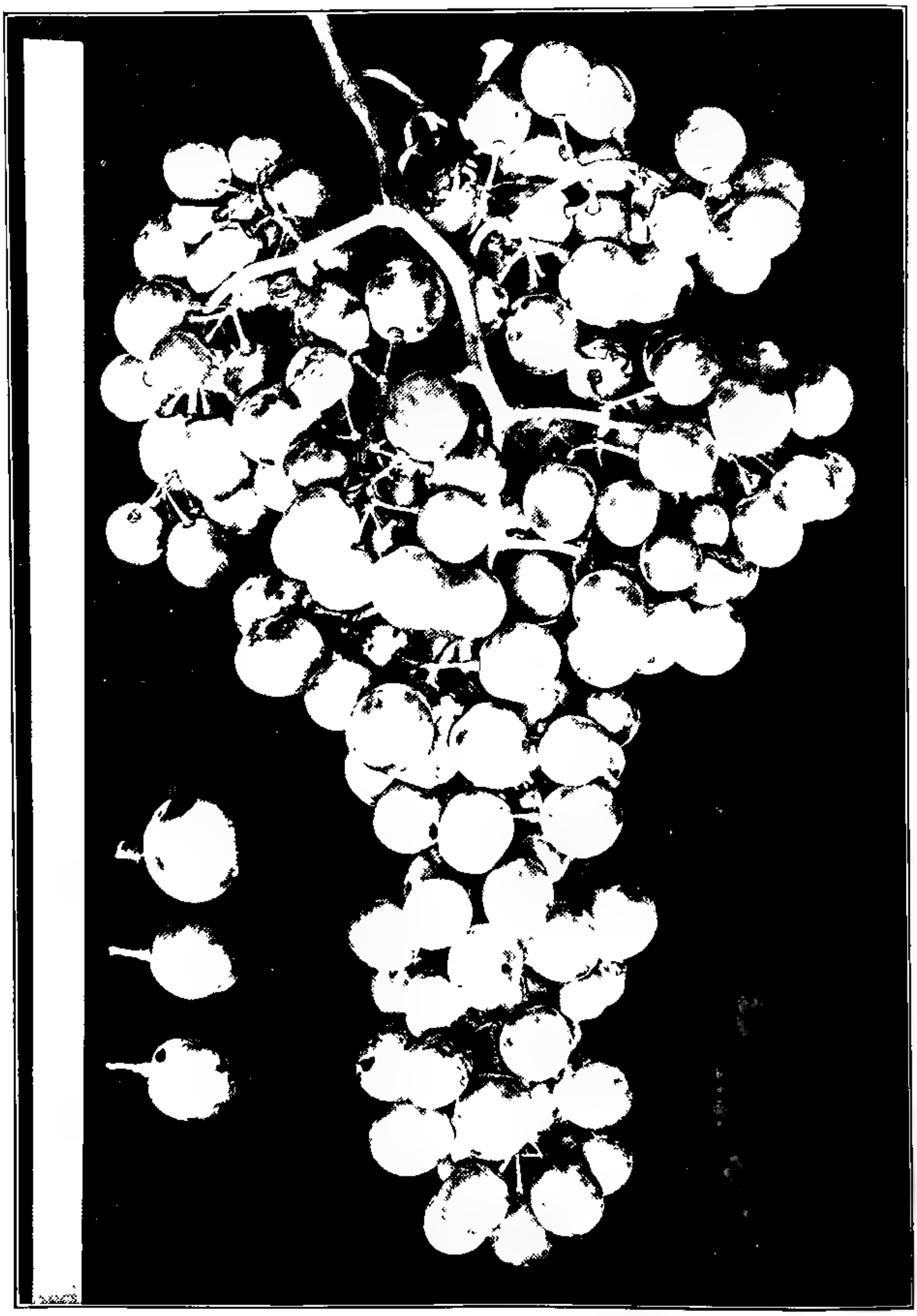

FIGURE 1. A cluster of fruit from the new seedless grape. At the side are two of the berries beside an average-sized berry of the seeded variety Niagara. For the size of the cluster and the berries, compare with the scale of the ruler included.

staminate flowers and is hence without fruit; the other is the new seedless plant here reported.

The new seedless grape already obtained will be propagated by cuttings, which insures stability of type, and tested quite fully for hardiness and productiveness under the attention of the Department of Horticulture of the Experiment Station. If it proves worthy of general culture, the variety will in due time be more adequately described, named, and distributed.

Vines of the various seedless varieties are now being grown with special care and protection, which, it is hoped, will ensure and provide a supply of pollen for further cross breeding. Also, the new seedless vine will furnish pollen for such use. It seems very probable that numerous seedless plants may thus be obtained which will differ in the size, color, and character of fruit and in hardiness and that from these plants varieties of merit which are suitable for culture may be selected.

A. B. STOUT.

THE WILLIAM R. SANDS FUND

In June, 1909, an unconditional bequest of $10,000 was received by the Garden from the estate of Mr. William R. Sands; this was at that time credited to the general endowment,[1] but by action of the Board of Managers on November 10, 1913, it was segregated as a special fund bearing the name of the donor, who had been a Life Member of the Garden from 1902 until his death in 1908.

Appropriations from the income, which is about $450 annually, were begun in 1914, for horticultural prizes, and continued for these purposes until 1924, with some accumulation unexpended; in 1925 the income and its accumulations were expended for publication; in 1926 it was appropriated for exploration, and aided the trip of Dr. P. A. Rydberg, Curator, to Minnesota and the Dakotas, Kansas, Iowa, and Nebraska for field studies desired for the completion of his work on the "Flora of the Northern Plains," planned as a companion volume to his "Flora of the Rocky Mountains and Adjacent Plains," published in 1917.

N. L. BRITTON.

[1] Journal N. Y. Bot. Gard. 10: 236. 1909.

NOTES, NEWS, AND COMMENT

The following visiting botanists registered in the library during the autumn months: Prof. H. H. Whetzel, Ithaca, N. Y.: Prof. Wm. G. Vinal, Syracuse, N. Y.; Prof. Frank W. Kern, State College, Pa.; Mr. Philip R. White, Baltimore, Md.; Messrs E. G. Arzberger and E. P. Killip, Washington, D. C.; Prof. Harold St. John, Pullman, Washington; Mr. J. A. B. Nolla, Rio Piedras, P. R.; Dr. A. B. Rendle and Capt. J. Ramsbottom, British Museum, London, England; Dr. Arthur W. Hill, Royal Botanic Gardens, Kew, England; Dr. Kathleen B. Blackburn, Armstrong College, Newcastle-on-Tyne, England; Dr. Thos. W. Woodhead, Technical College, Huddersfield, England; Prof. Dr. R. Chodat, Geneva, Switzerland; Dr. Paul Rüster, Botanic Garden, Breslau, Germany; Prof. Dr. E. Malinowski, Warsaw, Poland; Prof. Dr. K. Domin, Prague, Czechoslovakia; Prof. Dr. Al. Borza, University of Cluj, Roumania, and Prof. Dr. B. Issatchenko, Botanic Garden, Leningrad, U. S. S. R.

A cable message published in *The New York Times,* followed by a more detailed account to the *Times* through the mails, announces the unveiling, on November 26, of a memorial window to John Tradescant, the younger, in the Ashmolean Museum of the University of Oxford. This museum, said to be the oldest in the Anglo-Saxon world, and based largely on the collections of the two John Tradescants, father and son, came to the university as a gift from Elias Ashmole, friend and heir of the Tradescants. The younger John Tradescant is alleged to have made two voyages to America, one in 1642 and the other in 1654, both to the Chesapeake Bay region. He is said to have received a grant of land in Virginia, but spent most of his time in collecting specimens for his museum. He is reputed to have been "one of the first to advertise the great natural richness of America and to bring back to the mother country concrete evidence of the beauty and wealth of variety of the flora of the new lands across the sea." *Tradescantia virginiana,* the botanical name of the widely cultivated spiderwort, a native of our Atlantic coastal plain, commemorates both the Tradescant family and the colony from which the type of the genus was first brought to Europe. The new memorial window in Oxford is the gift of the garden clubs of Virginia. It was unveiled by Lord Fairfax of Cameron.

PUBLICATIONS OF

THE NEW YORK BOTANICAL GARDEN

Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its twenty-eighth volume.

Mycologia, bimonthly, devoted to fungi, including lichens; $4.00 a year; single copies not for sale. [Not offered in exchange.] Now in its nineteenth volume.

Addisonia, quarterly, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Subscription price, $10.00 a year. [Not offered in exchange.] Now in its twelfth volume.

Bulletin of The New York Botanical Garden, containing reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations. Free to all members of the Garden; to others, $3.00 per volume. Now in its thirteenth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. Planned to be completed in 34 volumes. Roy. 8vo. Each volume to consist of four or more parts. 56 parts now issued. Subscription price, $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Memoirs of The New York Botanical Garden. Price to members of the Garden, $1.50 per volume. To others, $3.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the twelfth volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

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THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

VOL. XXVIII FEBRUARY, 1927 No. 326

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

AMONG FLORAL ABORIGINES (CONCLUDED)
JOHN K. SMALL

THE IRIS TEST GARDEN
ETHEL ANSON S. PECKHAM

SOME RECENT INTRODUCTIONS IN THE COLLECTIONS OF LIVING PLANTS
KENNETH R. BOYNTON

JAMES FURMAN KEMP
ROBERT A. HARPER *and others*

THE HENRY IDEN FUND
N. L. BRITTON

A PORTRAIT OF JUDGE CHARLES P. DALY
N. L. BRITTON

NOTES, NEWS, AND COMMENT

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AMONG FLORAL ABORIGINES

(*Continued from page 20*)

Continuing eastward toward Fort Pierce, after the first third of the distance comprising scrub, pineland, and incidental hammocks along streams, we emerged into the low country—a southern extension of the lagoon-prairies about the headwaters of the Saint John's River. It is a primitive country—a crazy quilt, as it were, of prairies, marshes, cypress-heads, swamps, hammocks, patches of pine-trees, and cabbage-tree clumps. Extensive drainage operations were in progress, evidently in order to make the region habitable. But, from what we saw of the direct results, whether or not the land will be fit for settlement does not depend upon the digging of canals in it, but whether that part of the peninsula is rising or sinking, geologically speaking. At present, the representatives of man who choose to live there should be amphibious, as are the birds, shrubs, and trees that grow there naturally.

With the setting sun, nature's picture of the beautifully green cabbage-trees standing against the great gray stretches of the leafless cypress temporarily eclipsed any evidences of man's destruction mentioned above.

We began the celebration of Christmas day by a breakfast at Sebring in the lake region at dawn. We ended the day in the orthodox manner by a regular Christmas dinner at the village of Stuart on the eastern coast in the evening. The following day was devoted to studies and collecting along the eastern coast as far south as Miami.

The high and low hammocks held beautiful examples of different shades of green. The long-continued wet weather had put the woody vegetation in the best of condition and also the greens of the red-mangrove (*Rhizophora Mangle*), buttonwood (*Conocarpus erecta*), and poisonwood (*Metopium Metopium*) were striking. The branches of these trees were frequently the hosts of two of our rarer wild-pines (*Catopsis Berteroniana* and *C. nutans*). The broad short-tipped leaves of the first cited species are arranged in an urn-shaped structure which sits erect, and usually singly, on the branches of the trees. From this rosette of yellow-green and white-powdery leaves a stiff flower-stalk bearing a rigid panicle of flowers and fruits arises. The second kind of catopsis is gregarious, while from its rosette of slender-tipped deep-green leaves arises a weak flower-stalk with a nodding panicle. The most abundant air-plant in the cape regions is our rarest Florida species, *Guzmania monostachya*. It occurs in dense masses often of hundreds of plants in a colony of horizontal tree trunks. A half dozen kinds of other air-plants—wild pines—(*Tillandsiae*) complete the list of the bromeliads in the cape hammocks. The several kinds of epiphytic orchids have been mentioned in a former paper.[9] Two kinds of nightshades ever-bloomers and ever-fruiters—were much in evidence, the wild-potato (*Solanum Blodgettii*) and the bird-pepper (*Capsicum baccatum*). Both of the plants have bright-red fruits, but the fruits of the pepper are seldom seen mature and red, for the birds are so fond of them that all the berries approaching maturity are promptly picked off.

Most of the shrubs and trees of the Cape Sable hammocks are fleshy-fruited. There are over fifty prominent species bearing fleshy fruits, while there are scarcely one dozen prominent dry-fruited species. Among the latter we may mention:

Live-oak (*Quercus virginiana*)
Jamaica-Dogwood (*Ichthyomethia Piscipula*)
Coin-vine (*Dalbergia Ecastophyllum*)
Mahogany (*Swietenia Mahagoni*)
Cotton (*Gossypium hirsutum*)

[9] Journal of The New York Botanical Garden 17: 192–193. 1916.

Button-mangrove (*Conocarpus erecta*)
Red-mangrove (*Rhizophora Mangle*)
Black-mangrove (*Avicennia nitida*)

A poor showing as compared with the berry-bearers, which are too numerous to list here.

In passing, it may be said that not all the outlook was fresh and green. There were large gray and desolate areas. There were the hammocks that had been burned during the preceding drought. Just so much more to be added to the vast fire-devastated area of the state.[10]

A common European weed was observed in several hammock islands—the rib-grass (*Plantago lanceolata*). The seeds were evidently brought there in supplies for the dredge that made the canal and roadway. The seeds having sprouted in this unusual habitat, the plants were flourishing even more luxuriantly than in their usual more northern latitude. The ditches near tide level are often well stocked with floating aquatics, but in much less variety than those in the higher parts of the state. Two families only are represented, as a rule, by pondweed (*Potamogeton*), horned-pondweed (*Zannichellia*), and bladderworts (*Utricularia* and related genera).

The unusually high water interfered with the execution of some of our plans, so we moved northward to higher ground. Leaving the hammocks and the Lossman River limestone formation, we came to the front prairie on the Miami limestone, as the southern extension of the Everglades is often termed. About the transition from one geologic formation and at the same time plant-association, many kinds of birds were seen various kinds of herons, ibises, eagles, vultures, crows, hawks, etc., etc., and smaller birds.

The trees of the miniature forests of pond-cypress (*Taxodium ascendens*) were in their ghost-like make-up.[11] Some of the trees were wholly naked. On some a few leafy branches were evident. Others were copiously flowering. A few showy flowers decked the prairie in the vicinity of the cypress. Patches of white and three colors were sometimes seen. The elements were mostly lancehead (*Sagittaria lancifolia*), southern cowbane (*Oxypolis*

[10] See Journal of The New York Botanical Garden **22**: 39. 1921.
[11] See Journal of The New York Botanical Garden **25**: 72–73. 1924.

teretifolia), piriquita (*Piriquita glabrescens*), marsh-pink (*Sabbatia grandiflora*), and lobelia (*Lobelia glandulosa*). As is usual at that season, the clumps of saw-cabbage palm (*Paurotis Wrightii*) thrust their flaming tongues—panicles of ripening fruits—above the heads of iridescent leaves.

A short incursion was made into Royal Palm Hammock, mainly for the purpose of studying the native cycad—*Zamia silvicola*. This kind of coontie proves to be the same as that once found in the hammocks of Robert's Island in the Everglades[12] and recently discovered in great quantities on the kitchen-middens of the western coast of Florida. So far it has been found only in localities of aboriginal settlements.

Little was in bloom in the hammock, except the tall royal-palms (*Roystonea regia*). However, the vegetation of the neighboring pinewood had responded to the long spell of spring-like weather, and thus flowers of five or six colors and white were here and there in evidence, on both woody and herbaceous plants. More conspicuous among others were the ram's-horn milkweed (*Echites Echites*), the red pleurisy root (*Asclepias decumbens*), the yellow Bahama-senna (*Cassia bahamensis*), golden-rod (*Solidago Chapmanii*), rattle-box (*Crotalaria pumila*), the green varnish-leaf (*Dodonaea jamaicensis*), the purple-thistle (*Cirsium Smallii*), and the blue vervain (*Verbena maritima*).

From Florida City we drove eastward to Bay Biscayne.[13] A short distance out on the prairies the yellow-flowered woody plants were in bloom and in fruit. The one, a willow (*Salix amphibia*), often begins to flower in the autumn. It is the kind that forms the willow-heads on the edges of the Everglades and in the prairies, where its stems are often horizontal and much-branched. The low often prostrate branches and the wet habitat make these willow heads the favorite haunts of the water-moccasin. The other yellow-flowered shrub—an evening-primrose (*Jussiaea decurrens*)—had showy flowers, but the petals fall from the flower with the slightest shock. The common guava (*Psidium Guajava*) was naturalized at many places in the higher

[12] See Journal of The New York Botanical Garden **18**: 102. 1917; **27**: 121–129, *figs. 1 & 2*. 1926.

[13] See general description of the region in Journal of The New York Botanical Garden **19**: 279–281. 1918.

parts of the prairie. The wet parts were often hidden by a mass of broad leaf-blades of three monocots—wild-arum (*Peltandra virginica*), wampee (*Pontederia cordata*), and "lilies" (*Thalia divaricata*).

An interesting phenomenon was observed out near the bay. Two plants of closely related families, the one a low native herb —lizard's tail (*Saururus*)—and the other a tall exotic, but naturalized tree—Australian-pine (*Casuarina*)—were thriving in the salt water that came in with the tide from Bay Biscayne.

Still another side trip was made in that vicinity to an island comprising between three and four square miles lying in the front-prairie east of the settlement of Naranja. When that region was still in the homesteading stage (1904) we had crossed this island and found the limestone rocks covered with one of our rarer and odd ferns (*Odontosoria clavata*). This fern grew there by the acre and was often almost knee high. We found that repeated fires had almost exterminated it, for only a limited quantity was found growing in a small lime-sink where the fire had been unable to reach it. At the time of our early crossing dozens of spots were observed where deer had recently lain in the thick growth of this little fern. To-day the pinewoods are desolate, hundreds of the very numerous silver-palms (*Coccothrinax argentea*) have been killed by the fire. A few plants that bury their vital parts in the small erosion holes in the rocks survive and were even in flower at that time. Shooting-star (*Laciniaria*), pine-beauty (*Tetrazygia*), and locust-berry (*Byrsonima*) may be mentioned.

A CRUISE TO THE KEYS

The following day was devoted to a cruise to the upper Florida Keys. Two reports of the occurrence of the buccaneer-palm or hog-cabbage palm[14] (*Pseudophoenix vinifera*) on islands north of Elliott's Key, which was heretofore the northern known geographic limit of the species, were the incentive. An early start brought us, in the forenoon, to Sands Key, which is on the continental shelf opposite the Homestead region on the mainland. Accompanied by Wirth Munroe, who had stumbled on the buccaneer-palm there during the preceding winter, we landed and

[14] Journal of The New York Botanical Garden **23**: 33–43. 1922.

worked our way up a kind of swale for a half mile and then struck into the high hammock on our right. Heavy rains during the night and morning had left the hammock in a dripping condition. Although it was the first week in January, the advent of spring was evident. The air was fragrant with the honey-scented flowers of the saffron plum (*Bumelia angustifolia*). Among other woody plants the guiana-plum (*Drypetes lateriflora*) and the Hippocrates'-vine (*Hippocratea volubilis*) were flowering. Five kinds of air-plants wild pines (*Tillandsiae*)—were common. Some were in flower and some in fruit. The tree orchid (*Encyclia tampensis*), a summer blooiner, was sporadically in bloom. The native wild cotton (*Gossypium*) bore flowers and fruits on the same bushes. Its flowers open with a white corolla, which later turns deep pink.

A somewhat desultory search for the lone buccaneer-palm was fruitless. Tree-top observations were resorted to, and after several attempts success was achieved. The palm was completely surrounded by the hammock trees and its crown did not project above the leafy tree-tops. Its trunk is fully twenty-five feet high and is bent above the middle as a result of the proximity of a large pigeon-plum (*Coccolobis laurifolia*). Although the palm had produced fruit, evidently for many successive years, no progeny was found. The fruits are doubtless eaten by raccoons and rodents as fast as they fall to the ground. Other berry-fruits are much sought after by the raccoon, as is evidenced by the copiously scarred trunks, especially of the mastic (*Sideroxylon*), and the pigeon-plum.

A report of the existence of a lone buccaneer-palm on Ragged Key number six led us to stop on that island. This island lies directly north of Sands Key. Naturally it is low. Recently its entire surface elevated above tide has been changed by the pumping in of several feet of mud from the surrounding bay bottom. The one palm growing there naturally was protected by the engineer in charge of the dredging operations. However, it is not a buccaneer-palm, but a thatch (*Thrinax parviflora*). Naturally nearly all the herbaceous and shrubby vegetation of the island was destroyed when the mud was spread over the former surface. The various mangroves in the tidal swamp were spared. Several trees of the black-bead (*Pithecolobium guadelupense*) and blolly

(*Torrubia longifolia*) survived the suffocating layer of mud. Several barrier beach plants had taken a new lease of life, for example, the beach heliotrope (*Tournefortia gnaphalodes*), with heliotrope-scented clustered flowers whose corollas are white on the edge, but with yellow and magenta " eyes," the wild-poinsettia (*Poinsettia* sp.) with inconspicuous flowers, but with highly colored bracts that formed large red patches on the white sands, and the *Capraria biflora,* with starry white flowers, in this case borne on woody stems often three inches in diameter.

The prospective occupant of the Key had moved several bargeloads of humus from the Everglades and piled it up on the high land. The black-bean (*Dolichos Lablab*), the lima-bean (*Phaseolus lunatus*), and the garden lettuce (*Lactuca sativa*) had been introduced and were rampant all over the humus.

Some time was further devoted to the mainland between Bay Biscayne and the Everglades and to the Charles Deering reservations. With these studies completed, we made

A SECOND JOURNEY UP THE EASTERN COAST

The eastern coastal region was again made the object of some investigations. With these completed, our winter's raid came to a successful end.

The more or less sluggish creeks which drained from the Everglades into the Atlantic with unencumbered surfaces when we crossed them in the preceding summer now were covered with a growth of duckweed (*Lemna*), water-lettuce (*Pistia*), or water-hyacinth (*Piaropus*). The Carolina aster (*Aster caroliniana*) decked the cypress-trees which lined the creek-banks. The cypress here was often infested with the strangling-fig (*Ficus aurea*), just as it is up on the shores of Lake Okeechobee.

The low pinelands near Pompano yielded a purple aster of uncertain relationship. Other plants had recently come into flower in the low or wet pinewoods, and we found milkwort (*Polygala Rugelii*), sneezeweed (*Helenium Curtisii*), bladderwort (*Stomoisia Cornuti*), lobelia (*Lobelia glandulosa*), beggar's-ticks (*Coreopsis gladiata*) abundant. All these plants showed yellow flowers, except the lobelia. Purple or some related shade is usually the color seen in this region, emphasized by such flowers as thistle (*Cirsium*), false deer's-tongue (*Trilisa paniculata*), blazing-star (*Laciniaria*).

The dunes along Lake Worth had assumed more color within the couple of weeks just passed. Among the taller plants the yellow-lantana (*Lantana ovalifolia*), the blue Bahamian-potato shrub (*Solanum bahamense*), the crimson coral-bean (*Erythrina arborea*), and the greenish century-plant (*Agave decipiens*) were conspicuously numerous. The depressed or carpet-like herbs often covered square rods or even roods. Yellow carpets were dominant, and were the result of almost pure growths of the beach-sunflower (*Helianthus debilis*), rock-rose (*Crocanthemum corymbosum*), golden-rod (*Solidago sempervirens*), rattlebox (*Crotalaria pumila*), and the naturalized balsam-apple (*Momordica Charantia*). The only purple-flowered ground-cover plant then attractive was the tropical morning-glory (*Ipomoea cathartica*), whose myriads of flowers seemed more brilliant than usual.

It is curious how the color of the foliage of the plants along the high tide line varies. In the same position, we find the whitish-gray saw-palmetto (*Serenoa repens*), the beach-heliotrope (*Tournefortia gnaphalodes*), and the beach-tea (*Croton punctatus*) on the one hand, and the vivid yellow-green shrub lobelia (*Scaevola Plumieri*) with its immaculate white flowers and glossy purple-black berries.

Both north and south of the Jupiter River the two naturalized plants—rattlebox (*Crotalaria striata*) and mallow (*Sida cordifolia*)—were frequent both in the pinelands and in the scrub. Another exotic that was not uncommon and which seems to be pushing its geographic range northward was the pigeon-pea or Congo-pea (*Cajan Cajan*).

The vegetation of the level and the hilly scrub had not changed much since our recent trip through it. The spring growth, however, of the two conspicuous needle-leaved evergreens of the scrub was noticeable. The shoots of the rosemary (*Ceratiola ericoides*) and the spruce-pine (*Pinus clausa*) had elongated. As if to emphasize the holiday decoration custom, their erect shoots suggested myriad candles decorating the shrubs and trees. These two plants often occurred in such masses that the air was perfumed with the resinous odor of the spruce pine and the heath-like fragrance of the rosemary. In the hilly parts of the scrub the barren sands supported fine specimens of the plumed knotweed (*Thysanella robusta*) and the southern golden-rod (*Soli-*

FIGURE 5. On kitchen-midden at the mouth of Crystal River, Florida. The roots of a morning-glory—perhaps *Ipomoea macrorhiza.* This plant, in Florida, is found only on kitchen middens and aboriginal village sites. It is related to the Mexican *Ipomoea Jalapa,* and may have been one of the Indian economic plants. The largest root weighed over fifty pounds. The roots grow in the solid masses of shells. The great pressure necessary to make space for their growth is remarkable. The pink flowers are between three and four inches wide.

dago Chapmanii). The characteristic dune labiate (*Conradina grandiflora*), with stems six feet tall, when supported on the scrub oaks, was beginning to blossom profusely. On some dunes hundreds of dark green tufts of the foliaceous branches of pinweed (*Lechea*) were dotted over the white sand. Individual dunes often varied in the matter of their plant covering. For example, here a dune would have a woody plant covering, mainly spruce-pine (*Pinus clausa*), saw-palmetto (*Serenoa repens*), and scrub-oaks (*Quercus*), then one would exhibit only herbaceous plants, such as plumed-knotweed (*Thysanella robusta*), wire-weed (*Polygonella* spp. and *Delopyrum* sp.), pinweed (*Lechea* spp.), golden-aster (*Chrysopsis pilosa*), and woe-vine (*Cassytha filiformis*), either scattered or closely placed.

Just as the " scrub " is a miniature hammock, these dunes represent a miniature mountainous country. Thus we find ridges, peaks, valleys, coves, lakes, and streams.

Contrary to what one would expect, the further north we drove the more signs of spring appeared. The marshes and low pinelands showed patches of color indicating yellow-eyed grass (*Xyris*), piriquita (*Piriquita*), flaveria (*Flaveria*), and golden-aster (*Chrysopsis*). All these made yellow a prominent factor. The last-named plant probably represents *Chrysopsis Tracyi,* the narrowest-leaved species of the grass-leaved group of golden-asters in southern Florida. The white-flowered marsh-pink (*Sabbatia Elliottii*) was also prominent. Colors darker than yellow were represented by the pale-purple straw-stem (*Lygodesmia juncea*), and the rose-purple grass-pink (*Limodorum parviflorum*). Two kinds of butterwort, the yellow *Pinguicula lutea* and the purple *P elatior* were intimately associated. An albino of the latter species was not uncommon in the extensive patches.

On the dunes near Rio we found a new form of the tallow-wood (*Ximenia americana*). This species is represented in hammocks and scrub by a much-branched shrub or tree. Now we found it as a sprawling vine, with the long branches mostly prostrate on the sand.

The shore of Saint Lucie Sound was of interest as usual. Great masses of the naturalized yellow-flowered Asiatic vine—*Thunbergia alata*[15]—flowering prolifically, were frequent in the

[15] Natural History 20: 493. 1920.

hammock. This circumstance brought to mind the large number of naturalized exotics in this hammock, which was first settled in Seminole War times. More than two dozen kinds could be recorded for the few miles between Jensen and Fort Pierce. A partial list follows: papaya (*Carica Papaya*), castor-oil plant (*Ricinus communis*), Barbados-gooseberry (*Pereskia Pereskia*), sisal (*Agave rigida*), balsam-apple (*Momordica Charantia*), guava (*Psidium Guajava*), snake-cactus (*Selenicereus pteranthus*), queen-of-the-night (*Hylocereus undatus*), bowstring-hemp (*Cordyline guineensis*), leadwort (*Plumbago capensis*), century-plant (*Agave americana*), adgestes (*Adgestes clematidea*), scarlet-fruited gourd (*Coccinia cordifolia*), Australian-pine (*Casuarina equisetifolia*), etc.

In passing, it may be of interest to note that this beautiful bluff was once a favorite residential section of the aborigines, as is evidenced by kitchen-middens and burial mounds. Like all shores once occupied by the Indians this one is densely clad with cabbage-trees (*Sabal Palmetto*). The coconut also has been introduced here and there. However, one of the more striking peculiarities of this hammock is the large number of big succulents—native and naturalized; besides the two naturalized century-plants mentioned above, the two native Florida species are plentiful - *Agave decipiens* and *A. neglecta.* The cacti are represented by not fewer than eight kinds: prickly-pears (*Opuntia Dillenii, O. ammophila, O. Ficus-indica, O. leucotricha*), prickly-apple (*Harrisia fragrans*), dildoe (*Acanthocereus floridanus*), snake-cactus (*Selenicereus pteranthus*), and queen-of-the-night (*Hylocereus undatus*). Half of these species are natives, the other half are naturalized, the majority of the exotics having been introduced there nearly a century ago.

North of Fort Pierce there are three parallel elements in the geology and phytogeography, viz., the modern coastal dunes on the east, a high ancient ridge-like dune on the west, and a series of swamps between them. The swamps are often heavily hammock-clad. Curiously enough, the large and conspicuous trees are all "bays," viz., sweet-bay (*Magnolia virginiana*), bull-bay (*M. foetida*), loblolly-bay (*Gordonia Lasianthus*), and swamp-bay (*Tamala pubescens*).

Heavy rain set in before sun down, which put a stop to collecting plants. However, we continued northward to Cocoa, where

we stopped for the night, hoping that the weather would clear up through the night. We were not disappointed and the morning brought forth a favorable day for exploration on Merritt's Island across the lagoon –Indian River—from Cocoa.

Our plans included a more thorough investigation of the vegetation of the coquina formation at the southern end of the island, but as time failed us we sought nearer and virgin fields for exploration on this large island. We had scarcely started across the island when we spied an apparently new kind of aster in the low pinewood. It is related to *Aster grandiflorus,* a species of eastern Coastal Plain but of more northern distribution. Plants, additional to those mentioned above, were found in flower: roselings (*Cuthbertia*), vervain (*Verbena*), marsh-pink (*Sabbatia grandiflora*). Along the road the otherwise exposed damp sand was carpeted with a creeper related to our northern bluets, but with broad vivid green leaves and small white starry flowers (*Houstonia rotundifolia*). As we emerged from the first section of pinewoods on to the marshes, hundreds of large birds were feeding, not more than several rods distant, about some small pools. The majority consisted of at least four kinds of herons, cranes, and ibis. The wood-ibis was by far the most handsome of the congregation, especially when they flew away with the low sun shining on their silvery-white plumage and the shining black wing-margins.

The southern end of Merritt's Island is in the form of two narrow spits projecting into the lagoon, which on the western side is the Indian River and on the eastern the Banana River. The western spit terminates in the knife-like formation of coquina as described on a preceding page. The eastern spit is much smaller than the western. The higher land of this eastern spit is mostly pineland. Some hammock was evident, however, but this plant covering existed only on kitchen-middens. These aboriginal geologic formations were what we sought to locate as to position and study as to plant covering. The exact position is of historical importance, for the shells of the mounds are being carried away for making roads. Taking the position of a club house near the southern end of the spit and the bridge across the Banana River to the Cape Canaveral region as a starting point and traveling northward, we found the first midden 0.4 of a mile north of the

house and just south of the bridge. The second midden was 0.5 of a mile north of the house and just north of the bridge. The third midden with a burial mound was 0.7 of a mile north of the house. The fourth midden was one mile north of the house, a fifth one 1.4 miles up. Several areas of hammock near the shell mounds evidently represent village sites of the aborigines. Sheltered from the west and north winds by the Indian River, the pinelands of the island and the marsh, and with a warm easterly exposure, the tropical vegetation of these middens growing apparently without interruption for generations was very luxuriant.

The composition of the woody growth is almost as tropical as that of Key West, which is about three hundred and fifty miles further down the coast. The bulk of the hammock is made up of coral-bean (*Erythrina arborea*), white-stopper (*Eugenia buxifolia*), marlberry (*Icacorea paniculata*), myrsine (*Rapanea guianensis*), spice-tree (*Anamomis Simpsonii*), gumbo-limbo (*Elaphrium Simaruba*), wild-coffee (*Psychotria undata*), wild-coffee (*Psychotria Sulzneri*), pigeon-plum (*Coccolobis laurifolia*), sea-grape (*Coccolobis Uvifera*), wild-lime (*Zanthoxylum Fagara*), snowberry (*Chiococca alba*), Dillen's prickly-pear (*Opuntia Dillenii*), potato tree (*Solanum verbascifolium*), bay-leaved caper-tree (*Capparis cynophallophora*), Jamaica caper-tree (*Capparis jamaicensis*), torch-wood (*Amyris elemifera*), butter-bough (*Exothea paniculata*), mastic (*Sideroxylon mastichodendron*), blolly (*Torrubia* sp.), lancewood (*Ocotea Catesbyana*), randia (*Randia aculeata*), ironwood (*Krugiodendron ferreum*), saffron-plum (*Bumelia angustifolia*), guava (*Psidium Guajava*), bird-pepper (*Capsicum baccatum*). These tropical elements are offset by some of a more temperate character. For example: red-cedar (*Sabina silicicola*), Florida-privet (*Forestiera porulosa*), sugar-berry (*Celtis* sp.), poison-ivy (*Toxicodendron radicans*), tough buck-thorn (*Bumelia tenax*), live-oak (*Quercus virginiana*), toothache-tree (*Zanthoxylum Clava-Herculis*), and red-bay (*Tamala Borbonia*).

It will be noticed that all these shrubs and trees, except the live-oak, are fleshy-fruited or berry-bearing, or in other words, the fruits are eaten by birds, including migratory birds which on the one hand have been the agents that brought the ancestors of the tropical plants up the coast, while on the other the kitchen-mid-

dens with their continual supply of internal heat have been the means of continuing the existence so far north of their normal latitude. On these middens, northern and southern brothers and sisters, so to speak, mingled; respectively, *Bumelia tenax* and *B. angustifolia* and *Zanthoxylum Clava-Herculis* and *Z. Fagara,* or cousins *Tamala Borbonia* and *Ocotea Catesbyana.* Another cousin of *Zanthoxylum* was a naturalized exotic originally from China the orange (*Citrus*). The descendants of the ancestors of these orange trees introduced directly by the early Spaniards, or by the aborigines who secured them from the Spaniards, have perpetuated themselves for generations. The fruits they now bear are often scarcely larger than a good-sized lime.

The gnarled condition[16] of the live-oak was present, as it is on shell-middens. We noticed that the majority of the woody plants were much branched at or near the base, and copiously branched above. The torch-wood (*Amyris*) often appeared in large thickets only three or four feet tall and copiously laden with fruits. The sea-grape (*Coccolobis*) likewise was low in habit and prolific in fruit.

Only two herbaceous plants were common—two diminutive succulents—a spiderwort (*Tradescantella floridana*) and pellitory (*Parietaria floridana*). Two vines were usually in evidence, and both were tropical kinds. The hemp-vine (*Mikania cordifolia*) was conspicuous on account of its fluffy masses of pappus. The heliotrope relative (*Tournefortia ferruginea*) represents a species not before collected this side of the Gulf Stream. Its fruits are small white drupes with magenta spots.

The afternoon was devoted to some of the country a few miles north of Titusville. There we had the advantage of the company of Lewis A. Coleman, one of the early settlers of the upper Indian River region. We were still within the limits of aboriginal activities, as was indicated by a large Indian burial mound situated in the pinelands about five miles northwest of Titusville. This circular mound is made of sand of local origin. It is about two hundred feet in diameter and is now about twenty five feet high. Vegetation, at least at that time of the year, was sparse. It was all woody—long-leaf pine (*Pinus palustris*), scrub-oaks (*Quercus* sp.), and gopher-apple (*Geobalanus oblongifolius*).

[16] Journal of The New York Botanical Garden **25**: *pl. 285.* 1924.

We returned to the coastal region and went to the Turnbull hammock, as the hammock association adjacent to the coastwise lagoons rather indefinitely north and south of New Smyrna is locally known. Of course, this designation comes from Andrew Turnbull's connection with the early settlement of New Smyrna.[17] The deeper and richer parts of this hammock have never been botanically explored, and from our short incursion future exploration will yield interesting results.

The growth of springtime was evident everywhere. Broad-leaved monocots filled the swampy places and were in flower. The bulk of this swamp covering was the tropical lance (*Sagittaria lancifolia*), wampee (*Pontederia cordata*), Indian-shot (*Canna flaccida*), and wild-banana (*Thalia divaricata*). Sprawling blackberry bushes with large white flowers often lined the swamps, while in the higher lands members of the thistle family held sway—ironweed (*Vernonia altissima*), leaf-cup (*Polymniastrum Uvedalia*), and swamp-root (*Phaethusa virginica*). There we saw one of the plant objects of local interest—the "rudder-elm." This elm (*Ulmus floridana*) has developed seven flange-like buttresses, which are an inch or two in thickness. Some extend up the trunk as high as nine feet and on the ground for nearly or quite the same distance.

The trees were largely represented by temperate types; the shrubs and herbs were more tropical in character. As a result of a rich humus and moisture, vegetation was exceedingly rank. The trees were still dormant, for the most part. To the shrubs and herbs beneath them spring had come. Vines were abundant, varying from the woody grape (*Vitis*) and horse-brier (*Smilax*), to the delicately succulent wild-valerian (*Valeriana scandens*), which abounded with both its tiny pink flowers and numerous fruits, each with a tiny plume of hairs with which it is distributed by the winds. The wild-coffee (*Psychotria undata* and *P Sulzneri*), with the plants both in flower and in fruit, were rampant about the rudder-elm. Flowering herbaceous plants were numerous. One in particular should be mentioned, a jack-in-the-pulpit (*Arisaema*), curiously enough very closely related to our common northern species, *A. triphyllum*. The plants grew in colonies and varied in height from waist high to as high as one's head -certainly the giant among our "Jacks."

[17] Journal of The New York Botanical Garden 20: 198, 199. 1919.

There is another kind of "jack-in-the-pulpit" in the adjacent low pinewoods. This term is applied to the pitcher-plant (*Sarracenia minor*), which is important in the food economy of the young wild-turkey. The old turkey will take the young into a marsh where the pitcher-plant grows, peck a hole in the base of a leaf where the various entrapped insects are collected and let the young turkey feed on these delicacies.

Much could be written about the ferns in the Turnbull hammock, but this will be deferred until after a further study of them. However, the greatest surprise among all the ferns was the wood-fern (*Dryopteris floridana*) growing over one meter tall, closely resembling a species of wood-fern (*Dryopteris celsa*) heretofore only known from Lake Drummond in the heart of the Dismal Swamp in Virginia. Is this case merely a vagary of plant distribution or a concise example of our lack of knowledge of the distribution of the plants of the Eastern Coastal Plain?

We cannot leave the Turnbull hammock without some reference to its palms. There are few localities, as here, where one finds four kinds of palms growing together. They are the cabbage-tree (*Sabal Palmetto*), blue-stem or dwarf-palmetto (*Sabal minor*), saw-palmetto (*Serenoa repens*), and needle-palm or blue-palmetto (*Rhapidophyllum Hystrix*). Here again birds are brought to mind. The cabbage-tree was in fruit, and hundreds, if not thousands, of robins were feeding on the drupes. The reputation of the robin as a voracious feeder was sustained there, for the shower of partly digested pulp of the palm fruits from the alimentary tract of the birds, falling on the leaves of the lower palms sounded like a shower of rain!

These recent experiences emphasized the truth of the theory to the effect that peninsulas, capes, coastwise lagoons, and off-shore bars or islands are areas of exceptional interest, both botanically and floristically.

JOHN K. SMALL.

THE IRIS TEST GARDEN

In view of the extremely good condition in which the various iris plantings in the New York trial gardens were found by mem-

bers of The American Iris Society, the Directors of the Society, at their meeting on December 11, 1926, passed the following resolution:

Resolved: The Directors of The American Iris Society hereby put on record their appreciation of the work done and the interest shown by the employees of The New York Botanical Garden who were in direct charge of The American Iris Society's plantings and instruct the secretary to forward a copy of this resolution to Doctor Britton.

The general condition of the plants in the Iris Test Gardens during the year 1926 has been far better than at any time since the gardens were started. The Alphabetical Garden has become well established, showing good masses of color; the color-planting made a much better growth than was expected, a number of plants flowering quite well; and the beardless irises gave a really fine display, being, with the exception of one bed of Japanese varieties, perfectly satisfactory in every way. We sent twenty-four varieties of dwarf-bearded to Dr. Albert H. Wright, at Cornell University, to be used for study purposes in connection with the Test Garden there, and two hundred and fifty-four varieties to the Missouri Botanical Garden for their Test Garden, and about twelve varieties to the Display Garden at Larchmont. The Alphabetical Test Garden showed good bloom this year, some mistakes being discovered when it was checked over by Mr. Wister. The plants that were wrong were discarded, being replaced by others sent in for the purpose or from stock on hand. Plants of new introductions acquired were put in the reserve beds until the spring, when it is hoped they may be transferred to two new alphabetically arranged beds for the varieties received later than the varieties introduced up to the time the garden was laid out. In the color-planting, the three beds of dwarfs and the one of intermediates which were replanted in 1924, gave a wealth of bloom. Where the spaces allotted to a variety had been sparsely filled, we divided the plants to make a better effect and some slight changes and corrections were made. In the "beardless" garden, some varieties which we received either through gift or purchase, and which were needed to extend the collection, have filled the beds. The section devoted to Dr. Small's native irises was checked over early in the spring and records made for our hardiness test. The gaps caused by winter-killing were filled in from

the frames to allow another season's trial. New beds were added and plantings made of portions of all natives collected by Dr. Small during the year, with the exception of those that came in too late in the autumn to carry safely over winter. Some of these native irises are growing in the nursery under slightly different winter conditions and empty spaces were filled here too. Among the new plantings are a large number of *Iris versicolor* variations collected by Dr. Small and others in Vermont, Massachusetts, Connecticut and Maine. This winter the native varieties in the Test Garden will be left without a mulch or covering except for their own leaves and we expect better results than last year when the covering was put on too early, allowing moles and ground-mice to riddle the lower beds with holes which helped to "heave" the plants. In the nursery the introduced varieties sent in to compete for the Garden Club of America Medal and the American Iris Society Award of Merit were judged with the result that " Morning Splendour," raised by J. Marion Shull, deservedly received both the Medal and the Award of Merit. Seeds were collected from the crosses made by Mr. Clarence Moore and Professor Robert A. Greene, and planted with the help of Dr. Edmund B. Southwick. Something interesting may result from this. Seeds of described species were also collected and given to Mr. Boynton for exchange with other Botanical Gardens. The iris-borer has been conspicuous by its absence, showing that, if a little care is exercised in watching for it and if the borer or the larvae are destroyed whenever found, it is not a pest to be alarmed about. A few plants were affected by the new (?) disease which causes the roots to die off but these plants were promptly destroyed. One bed of Japanese varieties evidently suffered severely with this trouble the first year after planting, for great mortality occurred during the next winter. However, the remaining plants have struggled along this last summer and we hope to pull them through. We have at the present time some hundreds of plants in cold-frames and many others in the greenhouse. Most of the latter are varieties sent in from California, though there are a few of such low-growing natives as *Iris cristata* and *I. lacustris* which Dr. Small is trying to force into bloom ahead of the season.

Of iris plants received during the year, two hundred and ten were planted in the Test Garden, ninety-nine in the Alphabetical

beds, and nineteen in the Rock Garden. We have acquired three hundred and eighty-four plants through purchase or donation for Dr. Small to study and five hundred and fifty-two have been collected by Dr. Small himself. Plants sent in for the competition for "garden-value" number ninety one.

A list of donors of plants to the Test Gardens follows: R. M. Abbott, Mrs. J. C. Allison, Dr. W McL. Ayres, Miss F. L. Barrows, Frank W. Campbell, Mrs. F. E. Cleveland, Mrs. John S. Collier, Dept. of Geology, Northwestern University, Professor A. H. Greene, Hillcrest Gardens, Bernard H. Lane, E. G. Lapham, Movilla Gardens, Mrs. Collin S. McKinney, J. C. Nichols, Alice W. North, Mrs. Wheeler H. Peckham, J. Marion Shull, V. W. Stuhlsatz, Te A Wha Nursery, Mrs. W. E. Tobie, Miss Theodora Van Name, R. Wallace Co., Weed's Landscape Nursery, John C. Wister, Wyomissing Nursery Co., and Dr. Marshall A. Howe.

Plants were either purchased from or sent in to Dr. Small from: J. E. Alexander, D. Auld, C. D. Beadle, D. Demere, Grace S. Dyer, Alice Eastwood, D. W. Gross, H. M. Hall, S. Hitchcock, J. E. Kirkwood, D. T. MacDougal, Philip Muntz, Professor George E. Nichols, H. O'Neill, George E. Osterhout, L. H. Pammel, E. A. S. Peckham, Carl Purdy, E. N. Reasoner, A. H. Ross, A. P. Saunders, E. McE. Slater, and Dr. E. T. Wherry.

ETHEL ANSON S. PECKHAM.

SOME RECENT INTRODUCTIONS IN THE COLLECTIONS OF LIVING PLANTS[1]

Extensive additions have been made to the Rock Garden, poplar, and iris collections in 1926, and a great many tropical and hardy species new to the garden have been obtained. The genus *Millettia,* two species of which we have acquired, is closely related to and very like the Wisteria. *Millettia megasperma* is grown in California gardens as the "Winter Wisteria." Welwitsch wrote of *Camoensia maxima* as a most beautiful object, climbing over lofty trees and covering them with white and gold;

[1] Abstract of report presented at the Conference of the Scientific Staff and Registered Students of The New York Botanical Garden on December 1st, 1926.

the Brazilian *Myrciaria cauliflora,* the Jaboticaba, was considered by Barbosa Rodrigues to be the most beautiful plant in the Myrtaceae; both these we have now in our collections.

Plants of *Corylopsis pauciflora,* a low floriferous yellow-flowering shrub of the Witch-hazel family, have been added to the shrubby collection in the northern end of the Fruticetum, where several fine plants of *C. spicata* bloom early in April. The new species is said to be the hardier one. Species of *Rhododendron, Clethra, Philadelphus, Berberis,* and *Cotoneaster* derived from seed sent by the Royal Horticultural Soicety of England, the Edinburgh and Cambridge Botanic Gardens, and Royal Botanic Gardens at Kew, have enriched our hardy collections, together with plants of the genera *Keteleeria,* and *Callitris,* the Himalayan spruce (*Picea morindioides*), *Stranvaesia Davidiana,* a pomaceous shrub, and *Schizandra chinensis,* a magnolia relative which will probably be hardy here.

The Governor's plum, *Flacourtia indica;* the Circassian beadtree, *Adenanthera pavonina*; and the Queen's Flower, *Lagerstroema speciosa,* are other tropical subjects added to the conservatory collections this year.

We have more plants of *Hillebrandia,* the begonia relative, sent from Hawaii by Mr. Otto Degener, together with seeds of a tree violet, endemic Pritchardia palms, and other plants from those islands.

The Asiatic member of the bitypic genus *Menispermum, M. davuricum,* is another new plant recently received.

KENNETH R. BOYNTON.

JAMES FURMAN KEMP

In the death of Professor Kemp, November 17, 1926, the Board of Managers and the Scientific Directors of The New York Botanical Garden have lost an efficient and highly valued member.

Doctor Kemp was born in New York City, August 14, 1859, and became Professor of Geology in Columbia College in 1891. He was a member of the National Academy of Sciences, the American Philosophical Society, the American Academy of Arts and Sciences, and a member of the geological societies of Europe.

As Professor of Geology in Columbia, Doctor Kemp was *ex officio* a member of the two governing boards of the Garden from the organization in 1894, and was secretary of the Scientific Directors from 1896 to 1917. His service to the Garden covered thus the first and most critical period of its establishment and the formulation of its plans and policies. Doctor Kemp was a member of the organizing committee which determined the location of the Garden in Bronx Park and prepared the general plan for the position of its buildings and plantations.

The rapid growth of the Garden in its collections and equipment and in the confidence and esteem of the public we must believe was in no small degree due to the fact that it was able to command the services of men of such high scientific standing and notable reputation for wise and judicious management as Doctor Kemp.

In addition to his broad technical knowledge in geology, which was always placed at the service of the Garden when required, Doctor Kemp had a very special interest in and love for many phases of plant science and his work for the Garden was the expression of a genuine personal interest in the solution of the many problems which necessarily arose in the early stages of its growth and expansion.

His associates in the scientific direction of The New York Botanical Garden mourn the loss of a devoted and self-sacrificing friend and the services of a distinguished man of science.

ROBERT A. HARPER,
HERBERT M. RICHARDS,
CHARLES P. BERKEY,
FREDERIC S. LEE,
WILLIAM J. GIES,
HENRY H. RUSBY,
Scientific Directors of The New York Botanical Garden,
N. L. BRITTON,
Secretary.

THE HENRY IDEN FUND

This fund was established by the Board of Managers at a meeting held on November 10, 1913, in recognition of a bequest of

$10,000 received from the estate of Mr. Henry Iden. Mr. Iden became an Annual Member of the Garden in 1896, accepting such membership soon after the managers provided for the several classes of members, and continued until his death.

The annual income, about $450, was first appropriated for Resident Research Scholarships, and so continued into 1916, when part of it was expended for the purchase of books; in 1917, it was again applied to Resident Research Scholarships; in 1918, for books, and thus continued until 1924; in 1925, partly for publication and partly for laboratory supplies and equipment, and continued for laboratory purposes in 1926.

The Henry Iden Fund has thus been useful in providing means for aiding the investigations of students, in the building up of the library, and for other scientific and educational work.

N. L. BRITTON.

A PORTRAIT OF JUDGE CHARLES P DALY

In the JOURNAL for June, 1926, we had the pleasure of recording the gift, by Mr. Sturgis, of an oil painting of Mrs. Charles P. Daly. It is with great satisfaction that we can now record the gift of an oil painting of her distinguished husband, Judge Daly. The two portraits have been hung in the Library. At a meeting of the Board of Managers held November 18, 1926, the following resolution was adopted:

Resolved, That the Board of Managers of The New York Botanical Garden hereby expresses to Mrs. Emy Hoyt and to Mr. Frank K. Sturgis its grateful thanks for an oil portrait of Judge Charles Patrick Daly, early benefactor of the Garden, recently donated by Mrs. Hoyt through Mr. Sturgis.

N. L. BRITTON,
Secretary.

NOTES, NEWS, AND COMMENT

Dr. N. L. Britton, Director-in-Chief, and Mrs. Britton, Honorary Curator of Mosses, left for Porto Rico on January 20, expecting to devote two months to further botanical explorations of that island.

Part 3 of volume 6 of the Scientific Survey of Porto Rico and the Virgin Islands, including a completion of the treatment of the

Spermatophyta by Dr. N. L. Britton and Mr. Percy Wilson, and a description of the Pteridophyta by Dr. William R. Maxon, was issued last year. Part 1 of volume 8 of the same series, including the Mycology of these islands, by Dr. F. J. Seaver, Hon. Carlos E. Chardon, and others, appeared on December 29. Parts 1 and 2 of volume 7, covering Plant Ecology, by Drs. H. A. Gleason and Mel T. Cook are soon to be issued. All of these form parts of a 12-volume series now being published by the New York Academy of Sciences under the direction of a special committee of the Academy, headed by Dr. Britton.

The Board of Estimate of the City of New York has appropriated money for the electric lighting of a considerable part of the Museum Building of The New York Botanical Garden. Bids for the wiring were opened by the Park Department of the Borough of the Bronx on January 25.

Through the courtesy of Professor Rudolf Florin, of the National Museum of Stockholm, Sweden, the Garden has recently received a shipment of about fifty specimens, including forty-two different species of Triassic and Jurassic fossil plants, representing collections from a number of localities in widely separated parts of the world—Brazil, Antarctica, Spitzbergen, Japan, England, Austria, Bavaria, and Scandinavia. Those from the region last mentioned possess a special interest due to their association with the names of Nathorst, Halle, and other authors whose labors have contributed so much to our knowledge of Mesozoic fossil floras. The specimens from Antarctica are from the Jurassic of Graham Land, collected by the Swedish South Polar Expedition in 1903, and they are of especial value, as well as interest, for the reason that very few have been collected in the south polar region, and these particular ones represent the only ones in our Museum collections. The Garden enjoyed the privilege of a visit from Professor Florin last summer, and it may be of interest to note that among the material that was welcomed in nominal exchange for the foreign specimens were specimens of lignite and lignitic plant débris, collected in the Cretaceous clays at Kreischerville, Staten Island.

Meteorology for December. The total precipitation for the month was 3.64 inches, of which 1 inch, or 10 inches snow measurement, fell as snow—an unusually heavy fall of snow for December. The maximum temperatures recorded for each week or part of week were 45° on the 1st, 49.5° on the 12th, *52° on the 14th,* 48° on the 27th, and 45° on the 30th. The minimum temperatures correctly recorded by the thermograph were *7.5° on the 7th* and *on the 19th,* and 14° on the 27th.

Meteorology for the year 1926. The total precipitation for the year was 46.56 inches, including a total snowfall of 29.5 inches, which is figured as equal to 2.95 inches of rainfall. This was distributed by months as follows: January, 3.28 inches (including 0.4 as melted snow or 4 inches snow measurement); February, 4.72 (including 2.45 as melted snow or 24.5 inches snow); March, 3.08 (only traces of snow); April, 1.72; May, 1.64; June, 2.54; July, 6.19; August, 6.52; September, 4.13; October, 4.53; November, 4.57, and December, 3.64 (including one inch melted snow or 10 inches snow).

The maximum temperature recorded for the year was 102° on July 22d. The minimum temperature was 5° on the 29th of January. The first killing frost of the autumn occurred on the morning of the 16th of October with a temperature of 33.5° followed by a hard killing frost (31.5°) on the morning of the 22d. The latest freezing temperature of the spring was 26.5° on the morning of April 20th.

Meteorology for January. The total precipitation for the month was 2.77 inches of which 0.50 inches (5 inches snow measurement) fell as snow. The maximum temperatures recorded at the Garden for each week were 45° on the 4th, 40.5° on the 14th, 50° on the 22d, and *52° on the 29th.* The minimum temperatures were 12° on the 9th, 8° on the 16th, 22° on the 24th, and *0° on the 27th.*

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Mrs. E. Henry Harriman
Miss Olivia E. P. Stokes

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

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OF

THE NEW YORK BOTANICAL GARDEN

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THE BREEDING OF FOREST TREES FOR PULP WOOD

There is every reason to believe that a decided improvement of the various forest trees will result from proper selective breeding and hybridization. By such methods, the important cultivated plants of to-day have been obtained and are still being improved. Already among tree crops the results of such breeding have been most conspicuous in the various fruit trees, in certain of the nut trees, and in ornamentals. The similar improvement of forest trees grown for pulp wood and timber presents no essential differences as to methods of procedure or in the prospects for gratifying results. The importance of such results is apparent when we consider that pulp wood is now being consumed at least four times as fast as it is being grown. The main difficulty in breeding trees is that of the time required to assemble and to grow material for the breeding, and of the time one must wait for the seedlings to mature. Breeding trees is naturally a long-time problem.

In general, the steps to be taken in the breeding of trees may be summarized as follows:

1. The assembling of ample and suitable material for the breeding. This involves the survey of the species and varieties of the group under treatment and the introduction of as many as possible of the related species and varieties from all parts of the world having a climate similar to that of the area where the trees are to be grown. The main attention should, perhaps, be devoted first to those species and strains of known value and of greatest promise. The material collectod for use in the breeding should, however, be as extensive as is possible.

FIGURE 1. The work incident to obtaining seed in the breeding of poplars must, with few exceptions, be done high up in the trees. The trees must be climbed (1) to enclose female flowers before they are ready for pollination, (2) to secure pollen, (3) to make the pollination, (4) to remove paper bags when the pistils are no longer receptive, (5) to enclose maturing capsules in cheese-cloth sacks in order to prevent loss of seed, and (6) to collect the ripe seeds. The tree here shown is *P nigra charkowiensis* in Highland Park, Rochester, N Y.

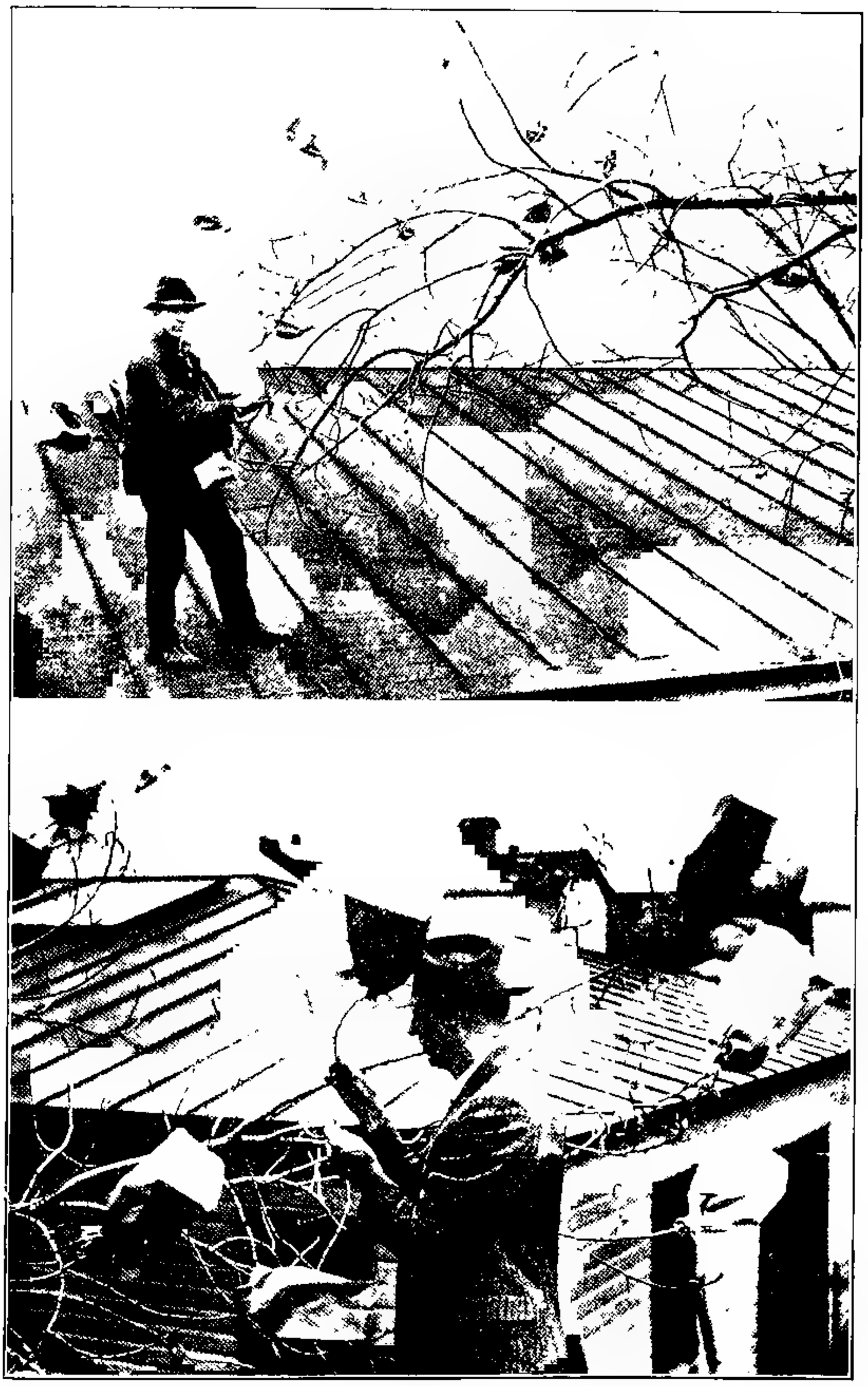

FIGURE 2. Working on trees of the northern necklace cotton-wood from the roof of buildings at the State Agricultural Experiment Station at Geneva, N. Y. Flowers that have been enclosed in paper bags are being pollinated.

2. Selective breeding from seed progenies within the species in order to isolate the strains that possess special merit and that are most worthy of propagation and of use in further breeding.

3. Cross-breeding or hybridization between species, varieties, or strains to produce types more or less new, especially in respect to rapidity of growth or immunity to diseases.

4. Propagation of the most promising strains that are isolated or produced, followed by proper tests for their adaptability to soil and climate.

If the propagation is to be by seed, then repeated selection will most likely be necessary before a strain can be maintained true to a type. The special qualities of " sport " seedlings and especially of hybrids seldom breed true in seed progenies. If, however, vegetative propagation by planting cuttings is possible and practicable, any single seedling of merit may be propagated as a clonal variety. Such propagation insures the greatest degree of uni formity possible among plants, for each plant is merely a branch of the one original seedling and only bud variations can give further inherent differences. The highly improved varieties or unusual types of fruit trees, nut trees, and ornamental trees are almost without exception grown as clonal varieties. Clonal propagation allows the propagation of a plant that may be sterile and unable to reproduce by seeds, a condition frequently seen in hybrids. In the development of improved varieties of forest trees, it will, therefore, be of advantage if vegetative methods of propagation are possible.

For forest trees that are to be grown as crops for pulp wood and for lumber, adaptivity to soil and climate, quality of wood for some particular use, freedom from disease, and rapidity of growth are characters of the first importance. Any variety worthy of special culture should possess these qualities.

Marked increase in vigor of growth beyond that seen in either of the parents is frequently obtained in hybrids. "Hybrid vigor" has long been observed by plant breeders. But cross-breeding between closely related strains may also give offspring that exhibit remarkable increase in the vigor of growth. Also occasionally an individual plant is found that noticeably surpasses all its sister plants in rate of growth and in size at maturity. In some cases, at least, it is found that such a plant has in the cells of its

FIGURE 3. The "good" seeds of poplars germinate quickly. The hybrid seedlings shown in these pans are only sixteen days old from the date of the planting of the seed. At this stage "damping-off" may develop and kill large numbers of seedlings unless preventive measures are employed.

FIGURE 4. Some of the best of the hybrid seedlings of the 1925 breeding when about 100 days old. The three at the left are from the cross *P. alba*×*P. adenopoda* The three at the right are from the cross *P. balsamifera virginiana*×*P. trichocarpa.* In the following year (1926) these plants were grown in a nursery and when they were 16 months old they had grown to the size shown in FIGURES 5 and 6.

FIGURE 5. A typical hybrid of the cross *P. balsamifera virginiana* × *P. trichocarpa* at the end of the second summer of growth from seed. The measuring stick is graduated in feet.

body an increase in the number of chromosomes over that characteristic of the species. Such sports and hybrids in general are not liable to breed true from seed but may be increased in number by vegetative propagation.

Among trees, several clonal varieties that possess noteworthy vigor of growth may be mentioned. One conspicuous case is the "Carolina Poplar" (*Populus Eugenei*). This clonal variety was evidently derived from a single seedling which was a chance and accidental hybrid between a hybrid poplar (*P. regenerata*) as a seed parent and the Lombardy poplar as a pollen parent. The original tree standing in the nursery of Simon-Louis near Metz, France, was described by Augustine Henry in 1914 as "the most wonderful tree in Europe in point of vigor." It was then 81 years old and "no less than 150 feet tall and 25 feet in girth at 5 feet above the ground and appears to be growing rapidly."

The rapid-growing poplar *P. regenerata* arose as a chance seedling in a nursery near Paris in 1814 and is supposed to be a hybrid. The poplar *P robusta* is from another chance seedling found at the Simon-Louis nursery in 1895. Apparently this is a hybrid between a form of the cotton-wood of eastern United States and a fastigiate form of the English black poplar. Plants of this clonal variety have a narrow columnar habit of growth and are reported to grow to a height of 90 feet in 18 years.

Some fifteen years ago Augustine Henry found that, besides the poplars already mentioned, such vigorously growing trees (clonal varieties) as the Huntingdon Elm, the Lucombe Oak, the London Plane, the Common Lime, and the Cricket-bat Willow are also accidental hybrids of the first generation. Henry says, "Why not, then, proceed to make artificially first crosses in other trees with still more valuable lumber," that "the only hope of salvation for forestry is in growing timber rapidly," and that "hitherto nothing has been done to improve the breeds of forest trees, and foresters have never even thought of the possibilities in this direction, though gardeners and farmers have shown the way for centuries."[1]

Professor Henry's interest in hybrid trees led him to make various crosses from which at least one poplar of value was obtained.

[1] Augustine Henry. On elm seedlings showing Mendelian results Jour. Linnean Society, Botany **39**: 290–300. 1910.

FIGURE 6. A hybrid between the white poplar, *P. alba*, and the Old-World aspen, *P. tremula Davidiana*, showing the rather remarkable growth attained at the end of the second summer from seed.

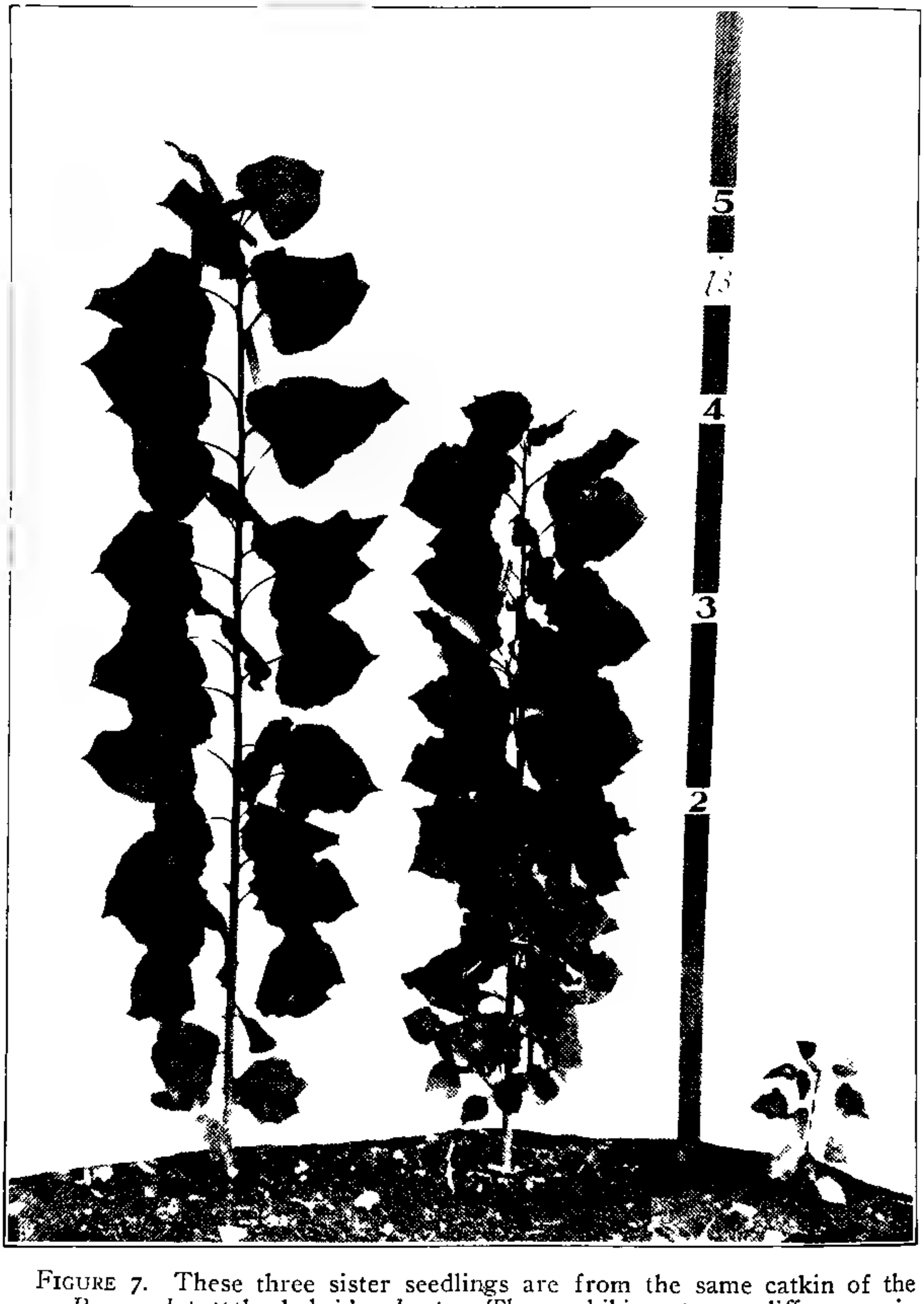

FIGURE 7. These three sister seedlings are from the same catkin of the cross *P. angulata* × the hybrid *robusta*. They exhibit extreme differences in the vigor of growth, such as are frequently seen when a hybrid is one of the parents of a set of seedlings.

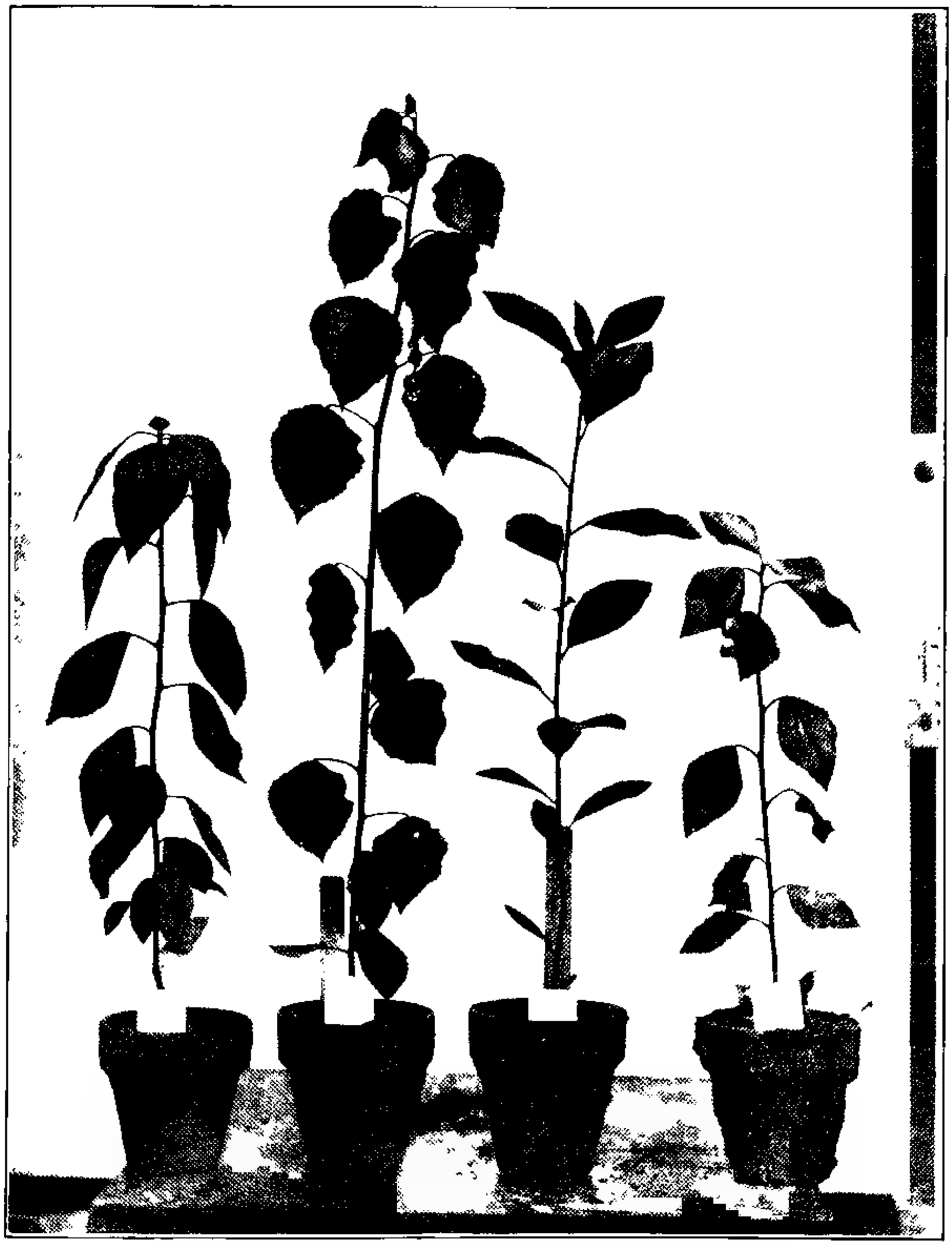

FIGURE 8. Some of the best of the hybrids obtained in 1926. From left to right: *P. Sargentii* × *P. trichocarpa*, *P. Sargentii* × *P. balsamifera*(?), *P. nigra* × *P laurifolia*, and *P. Sargentii* × *P. berolinensis*. These seedlings are all in 3-inch pots and are about 100 days old from date of seed planting.

In 1912, using trees growing at the Royal Botanic Gardens, Kew, England, he pollinated female flowers of a tree of what was considered as *Populus angulata* (evidently a form of the necklace cotton-wood of eastern United States, *P. balsamifera virginiana* Sargent) with pollen of a tree of *P trichocarpa.* He obtained some seed from which four seedlings were grown. These grew to a height of two inches during the first summer from seed. At the end of the second summer of growth the tallest was 3 feet 6 inches in height, and at the end of the next or third summer (1914) this plant was 10 feet and 1 inch tall. These hybrids were named *P generosa* and possibly two of them were propagated from cuttings under this name.

Perhaps the greater number of hybrids which it is possible to produce among plants will be either no more vigorous in growth than the parents or of less vigor, but, fortunately, some are likely to be of much more vigor than their parents.

There is very little to indicate, in advance of the actual hybrids themselves, what crosses will yield offspring of noteworthy vigor. Such plants may even arise from parents of little worth and of comparatively slow growth. In breeding for vigor of growth in any group of plants, as many crosses should be attempted as are possible. The chances for obtaining the very best hybrid will thereby be increased.

The breeding of the various poplars along the lines mentioned in the preceding discussion is a definite project now being undertaken by the Oxford Paper Company through its Research Department in coöperation with The New York Botanical Garden.

This particular project had its inception in a statement by Professor Ralph H. McKee in an article on " Proper Reforestation " printed in 1916 in the publication " Paper." After citing cases of vigorous growth in poplars and other hybrid trees, he makes the following statement regarding reforestation for pulp wood:

" The practical solution of the problem will be to get together specimens of the twenty-five or thirty varieties of poplar known in this country and abroad, cross them, grow the resulting hybrids, and test the woods obtained from these hybrids for pulp-making qualities. From the results obtained, choose the hybrid that in growth of wood, quality of wood considered, is the best, and, using this tree as a source of stock, reforest the cut-over pulpwood lands."

The coöperation and the financial support necessary to engage in such a project were not secured and combined until the spring of 1924, when the three authors of this report coöperated to begin this work. Since then the breeding of poplars has been prosecuted with vigor.

A main feature of this breeding is the hybridization of as many species and varieties of poplars as is possible with first consideration to those that are most hardy and most vigorous in growth. Fortunately for the progress of this work, many kinds of poplars of blooming age are included in the collection of trees growing at The New York Botanical Garden and at Highland Park in Rochester. Both male and female trees of the northern form of the necklace poplar (*Populus balsamifera virginiana*) were available for use in breeding on the grounds of the New York Agricultural Experiment Station at Geneva, New York. Permission to work with these trees was kindly given by the proper officials of the Experiment Station and of the Park Department of Rochester. The relative seasons for the blooming of the poplars at these places are such that the pollinations can be completed at The New York Botanical Garden before it is time to begin similar work at Geneva and Rochester.

This breeding is being done almost entirely by controlled pollination, which, for the most part, must be made high up in the trees. The female catkins are enclosed in paper bags before the flowers are ready for pollination and each of the later operations is performed in its proper turn.

Many special problems have been encountered in the course of the work. The viability of the pollen produced by each male tree used as a parent has been tested by artificial germination on culture media. By such tests the length of time pollen of poplars may be kept viable has been determined. Means of collecting pollen and of hastening and retarding the shedding of pollen have been devised. Of other matters requiring special attention, mention may be made of (1) methods of collecting, preparing, and planting seed; (2) care of young seedlings and especially in regard to the control of damping-off fungi; and (3) the handling of young trees in the nursery. Attention has been given to the methods of planting poplars in various soils, to the best means of storing cuttings, to studies of the fungi which attack poplars, and to

the length of fiber in various species, clonal varieties, and hybrid seedlings. Discussions of these and of other phases and results of the investigations will appear later in further papers.

The breeding work has been highly successful in the production of a large number of hybrids, some of which show promise of being valuable as pulp-wood trees. Seedlings have been obtained from 96 different cross-combinations between species and varieties. Breeding within several species is also well under way. A total of over 13,000 seedlings are now being grown. From various of the cross-pollinations large numbers of seed were obtained, but the number of seedlings reared from any one cross was usually limited to 200, although in a few cases the number of sister hybrids being grown is about 500.

The northern strain of the necklace cotton-wood (*P balsamifera virginiana* Sargent) has been used quite freely in the breeding both as male and as female parents. This species grows rather widely in New York State, where certain trees may be seen with trunks of a circumference of over 20 feet.

Another species used rather freely in the breeding is *Populus trichocarpa,* which grows wild from southern Alaska through western Washington, Oregon, and California to the San Bernardino Mountains. In certain localities it is nearly 200 feet in height, with trunk diameters of seven or eight feet. It is the largest of all the broad-leaved trees of North America. Various forms or varieties of the black poplar (*P. nigra*) of Europe have been used in the breeding, as have the white poplars *alba, alba canescens, alba nivea,* and *adenopoda.* Some of the most promising of the hybrids have come from such crosses as (1) *P. balsamifera virginiana* × *P. trichocarpa,* (2) *P angulata* × *P trichocarpa,* (3) *P angulata* × *P. balsamifera virginiana,* (4) *P. alba* × *P tremula Davidiana,* and (5) *P alba* × *P adenopoda.*

The hybrids obtained from the seed of the spring of 1925 have now had two summers for growth; the first summer in seed pans and small pots and the second in a nursery. In a number of the groups of hybrids, plants have in this length of time grown to a height of over six feet and the very tallest seedling was slightly over seven feet tall.

All the seedlings obtained, whether from cross-pollinations or from inbreeding, are being carefully studied. Selections have

already been made of the most promising for rapid propagation as clonal varieties and for tests in reforestation and for studies of their pulp-making value.

The accompanying photographs illustrate certain phases of the work and various stages in the growth of some of the most promising of the hybrids obtained.

A. B. Stout, *New York Botanical Garden,*
Ralph H. McKee, *Columbia University,*
E. J. Schreiner, *Oxford Paper Company.*

ROSE PLANTS AND THEIR CARE[1]

We all love roses and know them to be the "Queen of Flowers." This hymn of praise on roses has been sung so often and in so many different keys that it probably will be of more interest to write about "Their Care" instead.

All field-grown roses are hardy, but in order to be assured of full success the advice given hereafter should be followed. They need the care of loving hands, as a mother's care and love are transferred to the baby. Roses like to be petted and played with and even then some disappointments will happen, for remember it is nature which often is forgotten. For instance, a rose bed which has been planted for two or three years will have a few plants missing now and then for reasons unknown. This is a disappointment, but we must remember that we enjoyed these few plants for a few years, had many flowers off them, while if we had gone to a flower store and bought a dozen roses at probably ten times the cost of these few plants, they would have given us pleasure for about two or three days only and then these beautiful roses would have wilted and passed from our view, while, after losing a plant in our garden which bloomed for three or more years, we have cut dozens of roses and have had years of pleasure in caring for them, besides beautifying our gardens.

The best roses to plant are the two year-old, low-budded, field-grown plants which have been hardened after being in the fields

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, November 20, by the President of The American Rose Society.

two winters; low-budding is essential to eliminate the so-called suckers or wild runners, besides making it easy to heel them in for winter protection, of which we will give a more detailed account later. Roses may be planted in the fall and spring. The advantage of fall planting is this—that the roses are established before cold weather sets in, and therefore have an earlier start in the spring, but even when the spring has advanced, roses can be planted out of pots, as certain firms keep these plants (grown in cold frames) in stock for anyone who forgot to buy roses until seen in bloom elsewhere.

While roses will endure poor conditions and flower under such conditions, the success which follows proper preparation makes that preparation always advisable.

Deep preparation of the soil is often urged, even to as much as three feet, and while in cases where drainage is poor this is important, it is by no means always essential. Good results may be had with far less expense and trouble. To stir the ground thoroughly to the depth of two spade-shoves, put down honestly nine inches each shove, will usually provide for root prosperity.

If the ground is soggy or wet, there must be a drainage provided—roses want plenty of water passing through the soil, but they will not endure wet feet! Rough clods, stones, bats, etc., to a depth of six inches will do the draining.

Roses are not dainty feeders. They like strong soil and plenty of food. The heavy soils, like those of clay, seem to please them most, though even in sand they will do well if additional food is supplied.

Well-rotted manure—cow manure preferred—horse manure nearly as good—is the key that unlocks the flower gates for roses. Plenty of it, to the extent of one-third the whole bulk that has been stirred up; well-rotted for certain; thoroughly mixed in the soil, so that the rose roots may easily find it; and the planter may feel that he has done his part.

Bone meal will help, if available, especially when worked into the soil as planting is done, at the rate of a large trowelful to a plant. Commercial sheep manure, in the same proportion, is useful.

Scotch soot, resulting from the burning of peat, is of known value, both as a fertilizer for spring dressing and to bother the

bugs; and any soot from a chimney above a wood-fire is valuable.

Well-rotted manure is the standby of the rose-grower, however. Put in plenty, and then put in some more when the beds are prepared. Dig more in each spring. Keep at it. Roses often starve to death, but seldom die of indigestion!

If at all practicable, the rose-bed ought to be ready long enough before the roses come to permit the ground to settle thoroughly. For early spring planting the preparation might well be made the preceding autumn, while for the desirable fall planting, several weeks of "settling" will help, though not essential.

When the roses arrive, the planter should have the ground ready. Open the package and separate the bundles, then "heel-in" —which is simply loose planting in a slanting trench—so that the plants can be taken out for setting, two or three at a time. Keep the roots covered all the time, and if it is windy, carry the plants to a place of planting in a pail of water. Rose roots are not intended to be exposed to the air; they belong in the ground.

After the hole is dug and ready, take a plant and carefully prune any mangled ends of the roots, using a sharp knife or pruning shears. If planting in the fall, cut the top but slightly, so that the final pruning may be done in the spring. If in spring, trim back all branches to not more than 3 to 6 "eyes," or buds, and remove entirely all but the 3 or 4 strongest shoots.

Set the plant in the hole, which ought to be larger than the net space required, spreading out the roots carefully, so that fine earth can be brought into contact with them. When they are thus separated and covered, fill in more good soil over the roots, firming it down with the hands. When the hole is full, stamp the soil firmly with the feet. Roses will not do well if loosely planted; the roots love firm soil.

Plant about two inches deeper than the "crown" from which the shoots arise. The deep planting is essential.

Plant hybrid tea and tea roses 18 to 24 inches apart, hybrid perpetuals 2½ to 3 feet, and climbers at least six feet.

Roses need continuous cultivation. Keep the soil stirred, so that it does not cake about them, but do not cultivate deeper than two inches.

Water thoroughly when the roses are planted. This means that the ground ought to be soaked to the depth of the planting. Dur-

ing the growing season a real thorough watering once a week will help. Do not " sprinkle " and think you are watering. Soak the ground when you do water, and then do not water again until the surface is quite dry.

Protect from bugs and bothers by spraying with Bordeaux mixture (see any good rose book for details) several times, prior to June 30, beginning while the plants are dormant. If the green aphis or plant louse comes, spray with a solution of soap, or with a weak solution of some nicotine preparation, like "Black-Leaf-40."

Very good results have followed the use of a mulch of about three inches of tobacco stems, the refuse from cigar factories. The earth is kept cool and the aphis repelled.

The dreaded " Black-Spot " is less likely to bother our outdoor-grown, husky roses than those that have been greenhouse-infected. Pick up and burn all dropped leaves, cultivate thoroughly, cut flowers with liberal stems, and vigorous growth will act as the best protection against insects and diseases.

The 1922 American Rose Annual prints in its complete article on rose insects and diseases a dependable treatment for " black spot." Before the disease appears, the plants are to be dusted, nine parts sulphur to one part powdered lead arsenate, and this treatment, repeated each three weeks during the summer, will also protect against powdery mildew and certain insects.

When winter comes and the ground has frozen, hybrid tea and tea roses need protection against the sun and the thawing of warm winter days. Evergreen boughs are ideal for this protection. In severe climates roses are protected by covering with earth, sometimes by covering also with boards to shed water.

The hybrid perpetuals are hardy, as are most of the climbers, but a little protection is altogether worth while for all of them. In this matter, as in other matters of rose prosperity, associating with other rose-lovers is invaluable. Join the American Rose Society, read its Annuals, and talk with the rose friends you will find in your vicinity. It is worth while.

F. L. Atkins.

STUDIES OF THE MIMOSAS

Plants of the Mimosa Family are very abundant in tropical and subtropical regions, both of the Old World and the New, but in the temperate zones they are little known except as ornamental plants in greenhouses. In the tropics they form vegetation of many kinds, from the small herbs which grow in the fields among grasses, with leaves sensitive to the touch, called sensitive plants, or in Spanish America *morivivi,* to large forest trees, valued for shade and for their wood; many of them are spiny trees or bushes, forming thickets difficult to penetrate; many, known in the West Indies by such names as catch-and-keep and *zarza,* are armed with recurved prickles, and become attached to the clothing of pedestrians. The majority have compound leaves, in many very much compound, formed of hundreds of minute leaflets; in some the leaves are much modified into peculiar flat structures called phyllodes. The individual flowers are mostly very small, or minute, but often numerous in round or long clusters, white, yellow, pink or red, some of the bushes and trees being very conspicuous and attractive when in bloom; one kind which inhabits the very dry southern side of Porto Rico, a bush three or four feet high, has round clusters of blood-red flowers, strikingly conspicuous; in some the flowers are deliciously fragrant, such as the bush known in Cuba and Porto Rico as *aroma,* with little round balls of bright yellow blossoms. Their fruits are of a great number of kinds, some flat and straight, some curved or coiled, some splitting into two valves, some remaining intact and releasing the seeds only through decay; an African tree much planted in tropical America, bears nearly white thin and dry drooping pods a foot long, which rattle in the wind, and is widely known as "woman's tongue." Besides valuable woods, other economic products are produced by plants of this family, such as gum arabic from a small tree of tropical Africa, and the seeds of some, as the mesquite of warm and tropical America, provide food for cattle; the seeds of others are highly colored and made into necklaces, as the red shining ones of the Circassian Bean of tropical Asia, introduced into tropical America, there known as *coralites.*

A collection of about 30 kinds included in the genus *Acacia* may be seen in the Central Display Greenhouse, Conservatory

Range No. 2, of The New York Botanical Garden; some of these are now in bloom.

A comprehensive study of the plants of this Mimosa Family inhabiting America is in progress by the writer and Dr. J. N. Rose, of the Smithsonian Institution, in which the very valuable herbaria of the Garden and the Washington institution are supplying most of the specimens for examination, several thousand having already been studied and classified, representing at least seven hundred different species growing in the West Indies, Central America, Mexico, and the southern United States. Many of these are new to science, and their description and classification will be a noteworthy contribution to American botany; the writer has studied most of the West Indian kinds in the field, Dr. Rose many of the Mexican kinds, and they have the coöperation of many other students of these plants in life, notably Dr. John K. Small, Head Curator of The New York Botanical Garden, for the southern United States, and Mr. Paul C. Standley, of the United States National Museum, for Central America.

The results of this investigation will be published by The New York Botanical Garden in "North American Flora."

N. L. Britton.

THE DARIUS OGDEN MILLS FUND

Early in the year 1910, the Garden received from the executors of the will of Mr. Darius Ogden Mills an unconditional bequest of $50,000, and at the meeting of the Board of Managers held on April 18th of that year the following resolution was adopted:[1]

Resolved: That in memory of Mr. Mills, and in appreciation of his services to the Garden as President of the Board of Managers, this gift of $50,000 be and is hereby designated the Darius Ogden Mills Fund.

Mr. Mills was one of the original incorporators of the Garden, a member of the Board of Managers from its organization in 1895 until his death in January, 1910, and President of the Board from 1898 to 1909, inclusive. He contributed largely to its original endowment and otherwise.

[1] Jour. N. Y. Bot. Gard. 11: 1; 225. 1910.

This fund yields income of about $2,300 annually. The first appropriations from the income were made in 1910, for the purchase of plants, and for botanical exploration and collecting. Subsequently the annual budgets have carried, in one year or another, appropriations for these purposes, and for horticultural prizes, laboratory work, lectures and lantern slides, the purchase and binding of books, research scholarships, docentry, photography, investigations at other institutions, museum and herbarium purposes, scientific supplies, and paintings and drawings of plants.

The fund has therefore aided practically all the educational and scientific activities of the institution, although its income is sufficient only to aid them in a modest way. The appropriation for 1926 was for publication.

N. L. Britton.

PUBLIC LECTURES DURING MARCH AND APRIL

The free illustrated lectures of The New York Botanical Garden during March and April are given in the Museum Building at 3:30 P. M. Doors are opened at 3:45 to admit late-comers. The program is as follows:

March 5. "Garden Soils and Fertilizers," Mr. J. G. Curtis.
March 12. "Floral Features of Florida," Dr. J. H. Barnhart.
March 19. "Through the Western Andes of Colombia," Dr. Francis W. Pennell.
March 26. "The Natural Bridges and Desert Flora of Southeastern Utah," Dr. P. A. Rydberg.
April 2. "The State Park at Devil's Lake, Wisconsin," Dr. A. B. Stout.
April 9. "With Burroughs and Muir in the Southwest," Dr. Clara Barrus.
April 16. "Coffee: The Plant and the Beverage," Dr. Ralph H. Cheney.
April 23. "The Tea Gardens of Ceylon and Japan," Dr. H. A. Gleason.
April 30. "Children's Gardens," Miss Ellen Eddy Shaw.

NOTES, NEWS, AND COMMENT

Among the visitors who registered in the library during the winter were the following botanists: Mr. James A. Crawford, Buffalo, N. Y.; Professor A. P. Saunders, Clinton, N. Y.; Professors H. H. Whetzel and M. F. Barrus, Ithaca, N. Y.; Dr. Matilda Moldenhauer Brooks and Mr. Arthur P. Kelley, New Brunswick, N. J.; Dr. J. N. Rose, Dr. Edgar T. Wherry, and Mr. W. W. Eggleston, Washington, D. C.; Mr. Myron A. Rice, Clemson College, S. C.; Mr. E. L. Lord, Gainesville, Fla.; Mr. Dow V. Baxter, Ann Arbor, Mich.; Professor H. M. Hall, Berkeley, Calif.; Dr. Mel T. Cook, Rio Piedras, P. R.; Dr. Elise Prossinagg, Vienna, Austria, and Professor Albert N. Steward, University of Nankin, China.

Meteorology for February. The total precipitation for the month was 2.42 inches, of which 0.4 inches (4 inches snow measurement) fell as snow. The maximum temperatures recorded for each week were 52° on the 2nd, 51° on the 12th, 50° on the 15th, and *61° on the 24th.* The minimum temperatures were *21° on the 5th,* 23° on the 14th, *21° on the 21st,* and 21½° on the 28th.

ACCESSIONS

LIBRARY ACCESSIONS FROM JULY 16 TO DECEMBER 31, 1926

BARTLETT, EDWARD EVERETT. *Edward Dean Adams.* New York, 1926. (Given by Dr. N. L. Britton.)

BERGER, ALWIN. *Die Entwicklungslinien der Kakteen.* Jena, 1926.

BIDDLE, JOHN BARCLAY. *Materia medica and therapeutics.* Ed. 13 revised by Clement Biddle. Philadelphia, 1895. (Given by Dr. J. H. Barnhart.)

BUIST, ROBERT. *The rose manual.* Ed. 4. Philadelphia, 1854. (Given by Dr. Walter Mendelson.)

CONN, HERBERT WILLIAM. *Evolution of today.* New York, 1889. (Given by Dr. J. H. Barnhart.)

———. *The living world.* New York, 1891. (Given by Dr. J. H. Barnhart.)

CRIDLAND, ROBERT B. *Practical landscape gardening.* Ed. 2. Sixth printing. New York, 1926.

Die Pflanzenareale; Sammlung kartographischer Darstellungen von Verbreitungsbezirken der lebenden und fossilen Pflanzen-Familien, -Gattungen und -Arten. 1 Reihe, Heft. 1. Jena, 1926.

Die Pilze Mitteleuropas. Bd. 1. Die Röhrlinge (Boletaceae). Lief. 1. Leipzig, 1926.

EAMES, ARTHUR JOHNSON, & MACDANIELS, LAURENCE HOWLAND. *An introduction to plant anatomy.* New York, 1925.

FAWCETT, HOWARD SAMUEL. *Citrus diseases and their control, with sections on oriental citrus diseases by H. Atherton Lee.* New York, 1926.

Garden guide; the amateur gardeners' handbook. Ed. 4. Fourth printing. New York, 1925.

GAUMANN, ERNST ALBERT. *Vergleichende Morphologie der Pilze.* Jena, 1926.

HAWK, PHILIP BOVIER. *Practical physiological chemistry.* Ed. 4. Philadelphia, 1913.

HEALD, FREDERICK DEFOREST. *Manual of plant diseases.* New York, 1926.

HERZOG, THEODOR. *Geographie der Moose.* Jena, 1926.

HOTTES, ALFRED CARL. *A little book of perennials.* New York, 1925.

———. *1001 Garden questions answered.* New York, 1926.

JEPSON, WILLIS LINN. *A manual of the flowering plants of California.* Berkeley, 1923–25.

JOHANNSEN, WILHELM LUDWIG. *Elemente der exakten Erblichkeitslehre, mit Grundzügen der biologischen Variationsstatistik.* Ed. 3. Jena, 1926.

M'COSH, JAMES, & DICKIE, GEORGE. *Typical forms and special ends in creation.* New York, 1857. (Given by Dr. J. H. Barnhart.)

MAUDE, AYLMER. *The authorized life of Marie C. Stopes.* London, 1924. (Given by the author.)

MEISEL, MAX. *A bibliography of American natural history.* Vol. 2. Brooklyn, 1926.

MOLISCH, HANS. *Pflanzenbiologie in Japan auf Grund eigener Beobachtungen.* Jena, 1926.

NOTCUTT, R. C. *A handbook of flowering trees and shrubs for gardeners.* London, 1926. (Given by Messrs. Martin Hopkinson & Co., Limited.)

NOTHNAGEL, HERMANN, & ROSSBACH, MICHAEL JOSEPH. *A treatise on materia medica (including therapeutics and toxicology). Translated from the 4th enlarged edition.* Vols. 1, 3. New York, 1884. (Given by Dr. J. H. Barnhart.)

PALMER, FREDERICK E. *Milady's house plants.* Rev. ed. New York, 1926.

PARSONS, SAMUEL BOWNE. *The rose: its history, poetry, culture and classification.* New York, 1856. (Given by Dr. Walter Mendelson.)

RAMIREZ GOYENA, MIGUEL. *Flora nicaraguense.* 2 vols. Managua, 1911. (Given by Dr. N. L. Britton.)

REHMANN, ELSA. *Garden-making.* Boston, 1926. (Given by Mrs. N. L. Britton.)

ROTMISTROFF, WLADIMIR G. *Das Wesen der Dürre: ihre Ursache und Verhütung.* Dresden und Leipzig, 1926.

SCHAFFNIT, JOHANNES MARTIN ERNST CHRISTIAN OTTO, & BÖNING, K. *Die Brennfleckenkrankheit der Bohnen.* Jena, 1925.

SHARP, LESTER WHYLAND. *An introduction to cytology.* Ed. 2. New York, 1926.
SHERMAN, HENRY CLAPP. *Methods of organic analysis.* Ed. 2. New York, 1919.
SINNOTT, EDMUND WARE, & DUNN, LESLIE CLARENCE. *Principles of genetics.* New York, 1925.
STEPHANI, FRANZ. *Icones Hepaticarum: index genera Hepaticarum.* n. p. n. d. (Given by Miss C. C. Haynes.)
STITT, EDWARD RHODES. *Practical bacteriology.* Ed. 5. Philadelphia, c1918.
STROM, KAARE MÜNSTER. *Norwegian mountain algae.* Oslo, 1926. (Given by Dr. M. A. Howe.)
THOMAS, HARRY HIGGOTT, & ARNOTT, SAMUEL. *Rockeries; how to make and plant them.* N. Y., n. d.
Tijdschrift over Plantenziekten. Vols. 1–32. Wageningen, 1898–1926. (By exchange.)
VINAL, WILLIAM GOULD. *A guide for laboratory and field studies in botany.* Ed. 2. Philadelphia, 1911. (Given by the author.)
WEAVER, JOHN ERNST. *Root development of field crops.* New York, 1926.
WEITZEL, WILLY. *Die Bedeutung der pflanzenlichen Nahrungsmittel für die Physiologie und Pathologie.* Radeburg, 1926.
WESTON, THOMAS A. *Bulbs that bloom in the spring.* N. Y., 1926.
Wissenschaftliche Ergebnisse der schwedischen Rhodesia-Kongo-Expedition 1911–1912 unter Leitung von Eric Graf von Rosen. Band 1. Botanische Untersuchungen by Rob. E. Fries. 3 Parts. Stockholm, 1914–21.

BOOKS FROM THE LIBRARY OF DR. J. H. BARNHART PURCHASED 1926 (CONTINUED)

CAMERARIUS, RUDOLPH JAKOB. *De Lolio temulento.* Tubingae, 1710.
CAPELLINI, GIOVANNI *Ricordi di un viaggio scientifico nell' America settentrionale nel 1863.* Bologna, 1867.
CARIO, OSCAR RICHARD. *Anatomische Untersuchung von Tristicha hypnoides Spreng.* Göttingen, 1881.
CARUEL, TEODORO. *Prodromo della flora toscana.* Firenze, 1860–64.
———. *Supplemento.* [Milano, 1865.]
The casket; or, flowers of literature, wit and sentiment. Nos. 1–12. Philadelphia, 1827.
CAVANILLES, ANTONIO JOSÉ. *Descripcion de las plantas que D. Antonio Josef Cavanilles demostró en las lecciones públicas del año 1801 [y 1802.] precida de los principios elementales de la botánica.* Madrid, 1802[–03].
CAVENTOU, EUGÈNE. *Du Carapa touloucouna (senegalensis).* Paris, 1859.
CAVOLINI, FILIPPO. *Zosterae oceanicae anthesis.* Neapoli, 1792.
CHAPMAN, ALVAN WENTWORTH. *Flora of the southern United States.* Ed. 2. New York, 1887. New York, 1889.

PUBLICATIONS OF

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Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its twenty-eighth volume.

Mycologia, bimonthly, devoted to fungi, including lichens; $4.00 a year; single copies not for sale. [Not offered in exchange.] Now in its nineteenth volume.

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Bulletin of The New York Botanical Garden, containing reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations. Free to all members of the Garden; to others, $3.00 per volume. Now in its thirteenth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. Planned to be completed in 34 volumes. Roy. 8vo. Each volume to consist of four or more parts. 56 parts now issued. Subscription price, $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Memoirs of The New York Botanical Garden. Price to members of the Garden, $1.50 per volume. To others, $3.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the twelfth volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 35,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

VOL. XXVIII APRIL, 1927 No. 328

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

THE AWARDS AND PRIZE-WINNING PLANS IN THE 1927 SMALL GARDEN COMPETITION

ISABELLA PENDLETON, HILDA LOINES, AND KENNETH R. BOYNTON

RHODODENDRONS AND AZALEAS FOR BREEDING PURPOSES IN AMERICA

CLEMENT GRAY BOWERS

COCOA AND CHOCOLATE

FRED J. SEAVER

THE ADDISON BROWN FUND

N. L. BRITTON

PUBLICATIONS OF THE STAFF, SCHOLARS, AND STUDENTS OF THE NEW YORK BOTANICAL GARDEN DURING THE YEAR 1926

NOTES, NEWS, AND COMMENT

ACCESSIONS

PUBLISHED FOR THE GARDEN

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Free to members of the Garden

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JOURNAL
OF
The New York Botanical Garden

VOL. XXVIII APRIL, 1927 No. 328

THE AWARDS AND PRIZE-WINNING PLANS IN THE 1927 SMALL GARDEN COMPETITION

The undersigned, the jury appointed to examine plans and award three prizes in the "Small Garden Competition under auspices of The New York Botanical Garden, 1927," report that 80 plans were submitted, of which 73 conformed to the conditions of the contest as published in the JOURNAL OF THE NEW YORK BOTANICAL GARDEN for November, 1926. As compared with the first contest, that of 1926, there was a considerable falling off in the number of plans presented, although the number of those that conformed to the rules was nearly as large. The members of the jury believe that the high quality of the plans submitted has made the contest altogether worth while. After careful deliberation, the jury awards the prizes as follows:

1. The first prize of One Hundred Dollars to
   (No. 56) Mr. L. L. Blundell, 34 Garrison Road, Brookline, Massachusetts.
2. The second prize of Seventy-Five Dollars to
   (No. 80) Mrs. James Stewart, P. O. Box 647, Easton, Maryland.
3. The third prize of Twenty-Five Dollars to
   (No. 68) Mr. James D. Graham, 157 Winthrop Road, Brookline, Massachusetts.

(Signed) ISABELLA PENDLETON,
Nominated by The Garden Club of America,

(Signed) HILDA LOINES,
Nominated by The Federated Garden Clubs of New York State,

(Signed) KENNETH R. BOYNTON,
Nominated by The New York Botanical Garden.

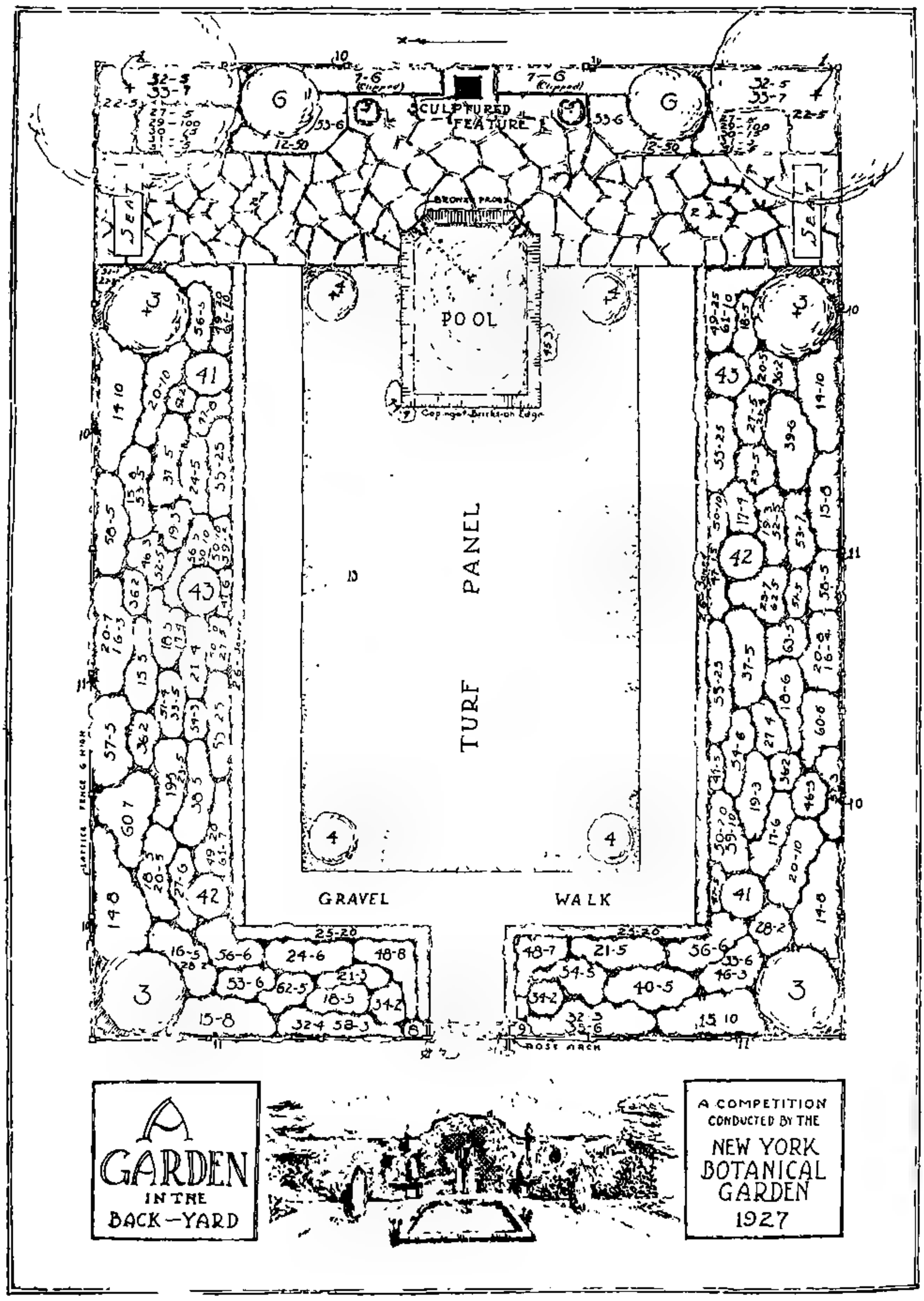

FIGURE 1. The first-prize plan, submitted by L. L. Blundell, Brookline, Massachusetts. (As here reduced, the scale is ¼ inch to approximately 2.75 feet.)

THE FIRST-PRIZE PLAN

Submitted by Mr. L. L. Blundell, 34 Garrison Road, Brookline, Massachusetts.

Key No.	Name	No. of Plants Used
1.	*Crataegus punctata*	2
2.	Moss Campion. To be planted among flag stones	100
3.	Common Lilac	4
4.	*Taxus media Hicksi*	4
5.	*Buxus sempervirens* Dwarf Box. In 20″-square white boxes.	
6.	*Rosa Hugonis*	2
7.	*Berberis Thunbergi*	8
8.	Rose Silver Moon	1
9.	Rose American Pillar	1
10.	*Clematis virginiana*	5
11.	*Clematis paniculata*	5
12.	*Pachysandra terminalis*	100
13.	Crocus in variety Planted in turf panel in groups of 3 to 7	100
14.	Hollyhocks, single, red, white, and pink	36
15.	*Delphinium Belladonna*	39
16.	*Boltonia asteroides*	12
17.	*Campanula persicifolia*	14
18.	*Aconitum Napellus*	26
19.	*Lupinus polyphyllus* Lupine, blue and white	12
20.	*Digitalis gloxiniaeflora*	45
21.	*Coreopsis lanceolata*	16
22.	*Cimicifuga foetida simplex*	12
23.	*Gaillardia grandiflora*	19
24.	*Veronica longifolia subsessilis*	11
25.	*Alyssum saxatile*	40
26.	*Alyssum maritimum* Dwarf Sweet Alyssum	seed
27.	*Anemone japonica alba*	30
28.	*Aster* Climax	4
29.	*Convallaria majalis* Lily-of-the-valley	200
30.	*Tradescantia virginiana*	30
31.	*Hosta plantaginea grandiflora* Great White Daylily	6
32.	*Thalictrum aquilegifolium* Meadow-rue	19
33.	*Aquilegia coerulea*	25
34.	*Echinops humilis* Low Globethistle	2
35.	*Helenium autumnale*	6
36.	*Gypsophila paniculata*	8
37.	*Phlox* Atlas, pink	10
38.	*Phlox* Boule de Feu, red	5
39.	*Phlox* Mrs. Jenkins, white	6
40.	*Phlox* Blue Hill	5
41.	*Paeonia anemonaeflora*	2
42.	*Paeonia* Festiva Maxima	2
43.	*Paeonia* Commodore Dewey	2
44.	*Iris pallida dalmatica*	4
45.	*Iris* Black Prince	3
46.	*Aster ptarmicoides*	15
47.	*Dianthus plumarius* Moss Pink	40
48.	*Nepeta Mussini*	9
49.	Tulips in colors desired, Darwin and Cottage	65
50.	Daffodils and Narcissus in varieties desired	60
51.	*Lilium regale*	15
52.	*Lilium Henryi*	10
53.	*Lilium candidum*	30
54.	*Pyrethrum roseum album*	14
55.	Pansies in variety	100
56.	Sweet William, red	22
57.	*Chrysanthemum* Bronze King	8
58.	*Chrysanthemum* Ouray	13
59.	*Calendula* Orange King	15
60.	Tall Late Cosmos	13
61.	*Verbena* Mayflower	7
62.	*Petunia,* dark blue	10
63.	*Platycodon grandiflorum album*	5

PRIZE GARDEN COMPETITION

THE NEW YORK BOTANICAL GARDEN —

BRONX PARK - NEW YORK CITY

- A SUBURBAN GARDEN -

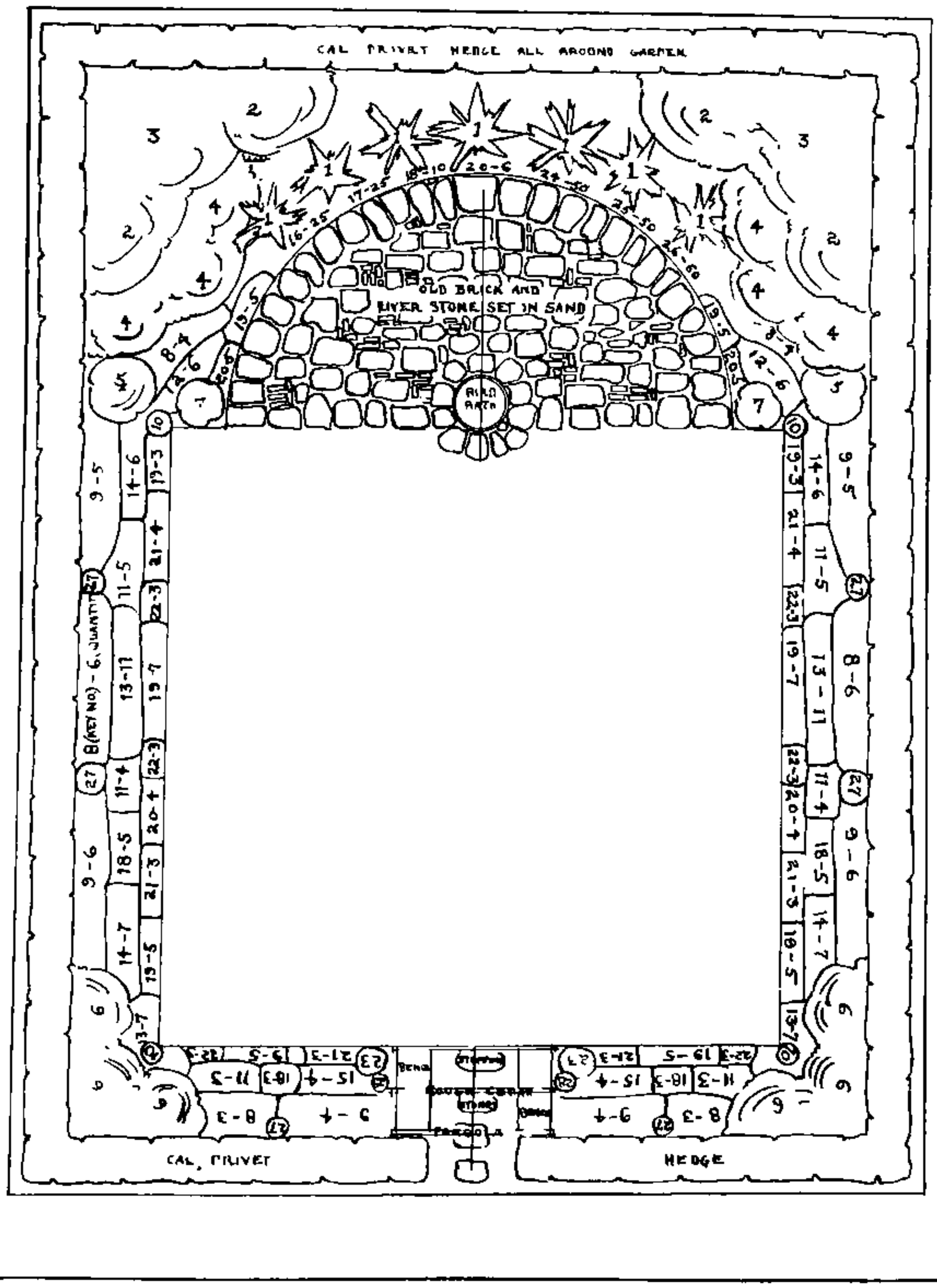

FIGURE 2. The second-prize plan, submitted by Mrs. James Stewart, Easto Maryland. (As here reduced, the scale is ¼ inch to approximately 2.7 feet.)

THE SECOND-PRIZE PLAN

Submitted by Mrs. James Stewart, Easton, Maryland.

Key No.	Name	No. of Plants Used
1.	*Juniperus virginiana* Red Cedar	7
2.	*Syringa vulgaris* Lilac, purple	4
3.	*Syringa vulgaris* Lilac, white	2
4.	*Symphoricarpos racemosus* Snowberry	6
5.	*Cornus florida* Dogwood, white	2
6.	*Forsythia intermedia* Golden Bell, yellow	6
7.	*Berberis Thunbergii* Barberry, clip as a globe	2
	PERENNIALS	
8.	*Delphinium* Larkspur, Gold Medal Hyb. Blue	26
9.	*Althaea rosea* Hollyhock, single, mixed	30
10.	*Asclepias tuberosa* Butterfly weed, orange	4
11.	*Phlox* Miss Lingard White	24
12.	*Iris germanica* Flag Lily, light blue	12
13.	*Iris germanica* Flag Lily, purple	36
14.	*Chrysanthemum* Button Yellow	26
15.	*Chrysanthemum* Pompom Lavender	8
16.	*Ceratostigma plumbaginoides* Leadwort, blue	25
17.	*Primula polyantha* Primrose, sulphur yellow	25
18.	*Aquilegia chrysantha* Columbine, yellow	26
19.	*Viola cornuta* Horned violet, mixed	50
20.	*Phlox subulata lilacina* Ground Moss, pale lilac	24
21.	*Dianthus plumarius* Clove Pink, white	20
22.	*Chrysanthemum coccineum* Pyrethrum, pink	18
23.	*Gypsophila* fl. pl. Babysbreath, white	2
24.	Ferns in variety Native ferns	50
	BULBS AND ROOTS	
25.	*Narcissus poeticus* Poet's Narcissus, white	50
26.	*Muscari botryoides* Grape Hyacinth, blue-white	50
27.	Dahlia Single, mixed	6
	ROSES CLIMBING	
28.	Rose Dr. Van Fleet Pink	1
29.	Rose Silver Moon Cream	1

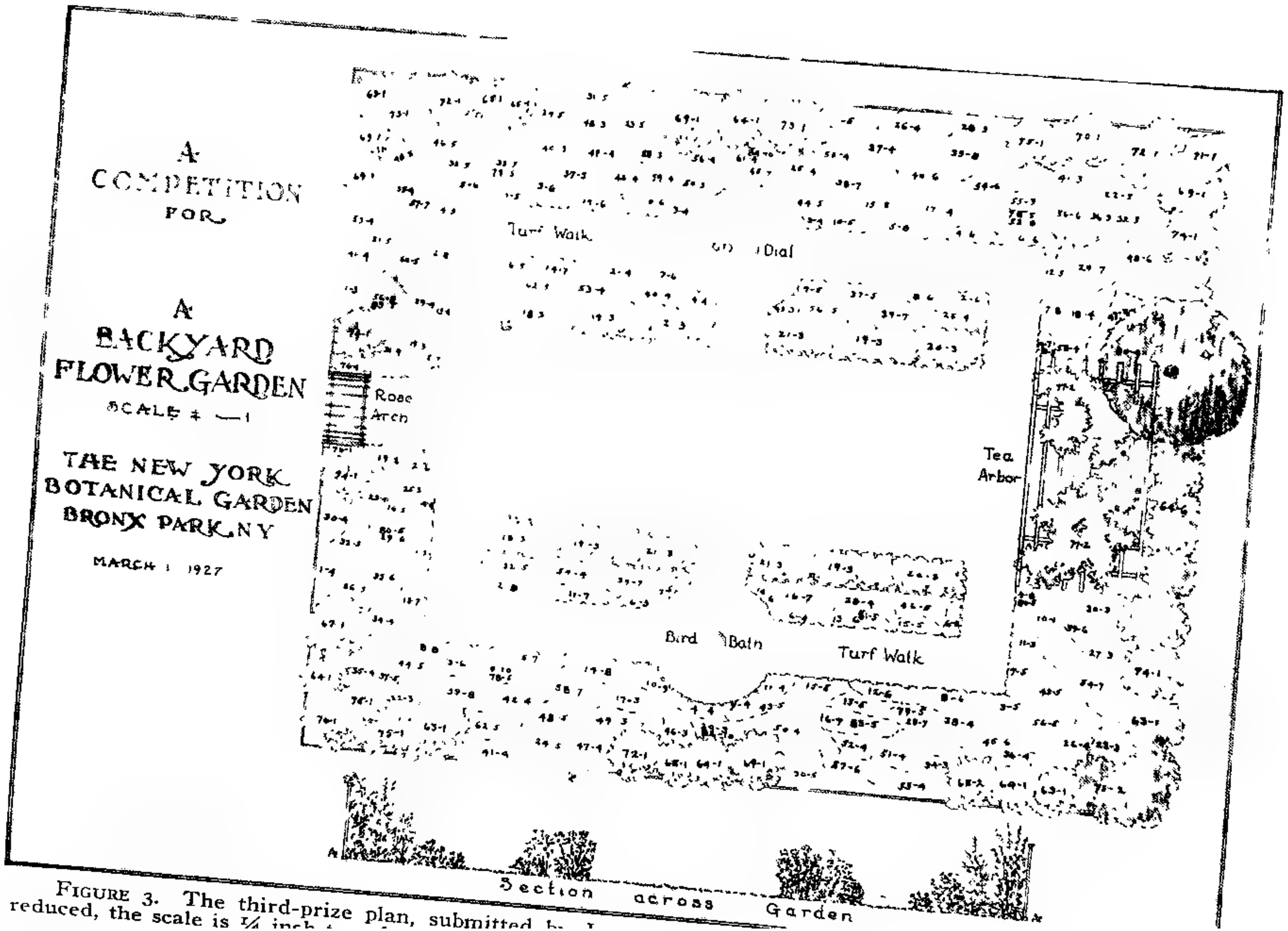

FIGURE 3. The third-prize plan, submitted by [illegible], reduced, the scale is ¼ inch [illegible]

THE THIRD–PRIZE PLAN

Submitted by Mr. James D. Graham, 157 Winthrop Road, Brookline, Massachusetts.

Key No.	Name	No. of Plants Used
1.	*Althaea rosea* Hollyhock	12
2.	*Dianthus Allwoodii* Pink	31
3.	*Dianthus plumarius* Pink	25
4.	*Campanula carpatica* Harebell	19
5.	*Campanula carpatica alba* Harebell	21
6.	*Alyssum saxatile compactum* Basket of Gold	23
7.	*Iris pumila cyanea* (blue)	33
8.	*Phlox subulata* Moss Pink	28
9.	*Bellis perennis* English Daisy	25
10.	*Convallaria majalis* Lily of the Valley	36
11.	*Cerastium tomentosum* Snow in Summer	21
12.	*Armeria maritima alba* Thrift	19
13.	*Erigeron glabellus* Fleabane	24
14.	*Papaver nudicaule* Iceland Poppy	22
15.	*Oenothera macrocarpa* Evening Primrose	24
16.	*Oenothera fruticosa major* Evening Primrose	19
17.	*Paeonia tenuifolia* Red	7
18.	*Paeonia* Fulgida Pink	6
19.	*Paeonia* Festiva Maxima White	12
20.	*Paeonia* Humei Rose	9
21.	*Paeonia* Edouard André Red	12
22.	*Papaver orientale* Royal Scarlet	11
23.	*Delphinium* Belladonna	9
24.	*Delphinium* Bellamosa	10
25.	*Phlox* Tapis Blanc	11
26.	*Phlox* Miss Lingard	11
27.	*Phlox* G. A. Stroehlein	7
28.	*Phlox* Bridesmaid	7
29.	*Pyrethrum roseum*	24
30.	*Aconitum Napellus*	16
31.	*Boltonia asteroides*	9
32.	*Gypsophila paniculata* flore pleno	18
33.	*Rudbeckia speciosa*	21
34.	*Dicentra spectabilis* Bleeding Heart	7
35.	*Lilium auratum* Goldband Lily	8
36.	*Lilium speciosum*	7
37.	*Gaillardia aristata*	22
38.	*Achillea ptarmica* The Pearl	14
39.	*Scabiosa caucasica* Empress Scabiosa	21
40.	*Aster* Favourite	15
41.	*Bocconia cordata* Pink Plume Poppy	12
42.	*Trollius europaeus* Globe Flower	8
43.	*Iris Kaempferi* Gold Bound	8
44.	*Iris germanica* Purple King	18
45.	*Iris germanica* Flavescens	13
46.	*Aster* Feltham Blue	13

47.	*Helenium autumnale* Riverton Gem	12	
48.	*Delphinium grandiflorum album*	19	
49.	Funkia or *Hosta caerulea* Plantainlily	10	
50.	Funkia or *Hosta grandiflora*	7	
51.	*Salvia azurea grandiflora* Blue Salvia	9	
52.	*Linum perenne* Perennial Flax	8	
53.	*Chrysanthemum uliginosum* Daisy	16	
54.	*Limonium elatum* Sea-lavender	17	
55.	*Kniphofia corallina* Torch-lily	3	
56.	*Astilbe Arendsi* Gloria Pink Spiraea	15	
57.	*Campanula Medium* Canterbury Bells	13	
58.	*Hemerocallis flava* Lemon lily	7	
59.	*Aquilegia*, double white	4	
60.	*Aquilegia chrysantha*	5	
61.	*Anemone japonica rosea superba*	4	
62.	*Digitalis purpurea* Foxglove	10	
63.	*Cornus alba sibirica* Red Dogwood	4	
64.	*Weigela* Weigela	3	
65.	*Rosa rugosa*	4	
66.	*Syringa vulgaris*	6	
67.	*Syringa persica* Persian Lilac	1	
68.	Apple, Duchess	1	
69.	*Philadelphus Lemoinei* Mock Orange	4	
70.	*Prunus triloba* Flowering Plum	2	
71.	*Lonicera Morrowii* Honeysuckle	3	
72.	*Forsythia intermedia* Goldenbell	2	
73.	*Spiraea* Anthony Waterer	2	
74.	*Spiraea van Houttei* Bridal Wreath (false)		
75.	*Cydonia japonica* Japanese Flowering Quince	3	
76.	Rose Dr. W. Van Fleet	2	
77.	Grape, var. Concord	4	
78.	Tulip Cottage Maid	10	
79.	Tulip Cottage Boy	10	
80.	Tulip (cottage) Emerald Gem	10	
81.	Tulip (cottage) Twilight	10	
82.	Tulip (Darwin) Andrea Doria	10	
83.	Tulip (Darwin) Flamingo	10	
84.	Tulip (Darwin) Viking	10	

As was done in the case of the first prize plan in 1926, The New York Botanical Garden will in the spring or early summer lay out and plant a garden on the lines of the plan winning the first prize in 1927. This garden will be located a little to the northwest of Conservatory Range No. 1, near the Model Garden of 1925 and a few rods west of the First Prize Garden of 1926.

ISABELLA PENDLETON,
HILDA LOINES,
KENNETH R. BOYNTON.

RHODODENDRONS AND AZALEAS FOR BREEDING PURPOSES IN AMERICA[1]

Although several of the most important species of ornamental rhododendrons and azaleas are native to the eastern United States, the breeding and improvement of this notable group of plants has been largely overlooked by American horticulturists during the last half-century. The varieties now grown and recommended for this country comprise very few sorts that were not included in E. S. Rand's list of 1876.[2] While American breeders have been inactive during the fifty years since elapsed, the English hybridists, introducing new species into crossed strains, have developed the size of the flowers to a diameter of six inches in some varieties, increased their floriferousness, improved their foliage and habit of growth, extended their color range, and lengthened the season of bloom.

The results of this work are not available to us in the northeastern United States, because the varieties thus produced are apparently too tender to withstand our cold winters and dry summers. For the same reason, it is not a program that we can copy. But it shows that rhododendrons and azaleas are amenable to improvement and constitute highly tractable subjects to work with. Moreover, our growing knowledge of the chemical, physical, and biological requirements of ericaceous plants is making it easier to grow them, so that they should no longer be regarded as difficult and costly plants to cultivate. The evergreen nature of some also commends them for use as landscape materials. And for magnificence of bloom the rhododendrons and azaleas are probably surpassed by no other shrubs.

If we desire to improve our own rhododendrons it would seem that an opportunity lies in the development of some distinctly American races of these plants, bred in this country to meet our own peculiar conditions and standards, irrespective of the ideals and fashions obtaining elsewhere. This principle might apply to both outdoor and greenhouse varieties, special strains being de-

[1] Report presented at the Conference of the Scientific Staff and Registered Students of The New York Botanical Garden on December 1, 1926.

[2] Rand, E. S. The Rhododendron. Cambridge, Mass. 1876.

veloped to meet each requirement. Obviously, hardiness is a prerequisite for all outdoor sorts.

Breeding work of this nature has this year been undertaken by the writer, who has received much valuable coöperation from Mr. Henry Hicks, of Westbury, N. Y., and from The New York Botanical Garden. It is planned to continue these investigations over a series of years.

Rhododendrons and azaleas are protandrous, although in some varieties the anthers and stigmas mature at nearly the same time. A few varieties appear to be feebly self-compatible, but self-incompatibility appears to be widespread. However, close pollinations are occasionally fertile, so that emasculation should ordinarily be practiced whenever several flowers of a cluster are covered by a single bag. Emasculations are made just before the flower buds open. The stigmas will remain receptive for a relatively long time—several days, or even a week—if protected by glassine bags. Pollen kept in a desiccator will remain viable, in some cases at least, for a fortnight or more, and the writer on one occasion used some with success after it had been stored for seven weeks. Definite knowledge concerning pollen longevity in these flowers awaits the discovery of a better medium for artificial germination than any that has been used thus far.

Some double forms, such as the Yodogawa azalea (*A. poukhanensis*), are completely sterile due to the total absence of both stamens and pistil. Other forms of sterility are found in certain clonal varieties where the stamens are absent or abortive. Some varieties produce pollen more abundantly than others and hence are better adapted for use as pollen parents.

Extremely wide crosses are possible in certain directions, and the successful matings are often between unexpected combinations. Successful matings, however, are very rare when crosses are made between the true rhododendrons and the azaleas. This year the writer attempted 52 combinations between azaleas and rhododendrons, involving some 400 pollinations, and secured only about 2 per cent. of apparently fertile crosses.

Well-known authorities, working extensively with the American species, classify this group of plants into several genera (*Azalea, Rhododendron, Biltia,* and *Rhodora*), while others who have given much attention to the Asiatic species group them all under the

generic name of *Rhododendron.* The latter usage is followed in the two most recent monographs, that of Millais (1917, 1924) and that of Wilson and Rehder (1921).[3]

Several hybrid races, comprising groups of clonal varieties, are recognized. In some cases these cultigen groups have been designated by specific names of their own. The more important groups are as follows:

1. Catawba Hybrid Rhododendrons (*R. maximum* × *ponticum* × *catawbiense* × *arboreum*).—A group of large, evergreen rhododendrons, parents of nearly all our hardy evergreen hybrids. The very hardy American species, *R. maximum,* was first crossed with the rather tender *R. ponticum.* The progeny had improved flower clusters. After the introduction into England in 1809 of another hardy American species, *R. catawbiense,* further crosses were made. A race of plants was then obtained which was fairly hardy, but which lacked brightly colored flowers, the colors being mainly magenta, lavender, and white. About 1825 the Himalayan species, *R. arboreum,* began to bloom in England. Although very tender, it bore brilliant blood-red flowers and was promptly crossed with the *catawbiense* hybrids in an effort to combine its magnificent color with their hardiness. In a measure this end was attained, but the resulting plants were still too tender to be reliable for our conditions. After generations of further breeding a few plants have appeared which have proved satisfactory for the United States, but the majority of bright-colored Catawba hybrids do not succeed well north of New York City. The few notable exceptions, however, which are of clear red and pink colors and also of "ironclad" hardiness, are the varieties which will be especially useful for further breeding. A larger number of other varieties of somewhat less hardiness will succeed well at New York City and on Long Island.

2. Caucasian Rhododendrons (× *R. caucasicum*).—A group of dependably hardy evergreen rhododendrons, somewhat dwarfer than the Catawba hybrids and blooming earlier in the season. The species and several of its varieties are white, but hybrid intermixtures have apparently extended the color range to pink and red. One variety tends to be cream-colored. All are valuable for their early blooming and hardiness.

[3] The nomenclature followed here is that of "Standardized Plant Names," 1923.

3. MAXIMUM RHODODENDRONS (×*R. maximum*).—These are clonal varieties of the native Rose Bay improved by inter-varietal and inter-specific crossing. They will not withstand drought so well as the Catawba varieties. They are valuable for their late-blooming quality.

4. ALPINE ROSE RHODODENDRONS (×*R. ferrugineum* and ×*R. hirsutum*).—These are dwarf plants suitable for rock gardens, and bearing small, magenta flowers.

5. R. GRIFFITHIANUM HYBRIDS.—This is a series of wonderful English-bred varieties with exceedingly large flowers. Variety *Loderi* is one of the best. Other species favored by European breeders are *R. Fortunei*, *R. Thompsonii*, and *R. arboreum*, with their hybrids. For mild sections of America they offer splendid opportunities to the breeder, but could hardly be expected to succeed in the colder regions.

6. R. JAVANICUM HYBRIDS (*R. javanicum* × *jasminiflorum*).—A race of beautiful greenhouse rhododendrons.

7. GHENT HYBRID AZALEAS (×*A. gandavensis* = *A. pontica* × *calendulacea* × *nudiflora* × *viscosa* [and possibly *rosea* and *arborescens*]).—This race originated about 100 years ago and was chiefly developed by the Belgian nurserymen, who selected and recrossed the best individuals over a period of many generations. The hardy American azaleas were crossed with the yellow Pontic azalea, *A. pontica*, which is tender here. The resulting race has abundant, handsome flowers, ranging from white through cream, yellow, orange, and rose to scarlet and crimson, but is generally short lived and tender in the north. Variety *plena* is double.

8. MOLLIS HYBRID AZALEAS (×*A. Kosteriana* = *A. mollis* × *japonica*. Includes also *A. albicans* and *A. viscosepala*).—These originated from seminal varieties of *A. mollis* about 1872 and were crossed with impure varieties of *A. japonica* and perhaps with *A. gandavensis* also. They have flowers up to three inches in diameter considerably larger than *A. gandavensis* and with a less tubular corolla. The color range is similar and the typical varieties are no hardier. Recently, however, an American-bred hybrid between the pure species, *A. mollis* × *japonica*, has been developed and appears to be perfectly hardy in Massachusetts. This variety is *Miss Louisa Hunnewell*, an orange-yellow azalea, and is equal in size and color to the typical *Kosteriana* hybrids. *R.*

viscosepala, var. *Daviesii,* has cream-colored flowers and is a very satisfactory plant around New York City. The tender yellow Chinese species, *R. mollis,* used as a parent, is generally held responsible for the tenderness of most of the "mollis" hybrids. ×*A. rustica flore-pleno* is a double-flowered race of complex ancestry, combining the Ghent and Mollis hybrids.

9. SNOW AZALEAS (×*A. ledifolia*).—Sometimes known as *Azalea indica alba*; these azaleas are grown outdoors as far north as Long Island. The flowers are large and white or lavender, and the summer leaves are persistent.

10. INDIAN AZALEAS (*A. Simsii* × *phoenicea* × *indica* × *ledifolia*).—These are the common greenhouse azaleas, hardy outdoors only in the south. Their colors are confined to the white-red-purple series, no yellows being present; single or double, and variegated in some varieties. *A. phoenicea* is an old cultigen group with purple flowers.

11. KURUME AZALEAS (forms of *A. obtusa*).—This group of small, compact, and highly ornamental azaleas has been developed in Japan and comprises many beautiful varieties. Unfortunately, young plants appear unable to endure the winter weather of New York without protection. The true Kurume azalea is the form *japonica.* The related form *amoena* and the variety *Hinodegiri* will grow in and near New York City, but are not regarded as hardy farther north. The group colors include crimson, rose, salmon-pink, and white. There are semi-double varieties. A certain amount of genetical work has been done upon this group by Miyazawa and Ikeno in Japan.

12. SANDER'S AZALEAS (×*R. Sanderi* Wilson = *A. Simsii* × *obtusa*).—A race of hybrids for greenhouse culture, recently bred in Massachusetts. It represents a cross between the Kurume and the Indian azaleas, combining some of the best qualities of each. This is a promising group for indoor culture.

It will be seen that nearly every group contains the "blood" of one or more tender species. Such races may be suitable for European conditions, but are generally unsatisfactory for outdoor culture here. The writer believes that improvements may be wrought by the elimination of these tender species from our breeding program and the substitution of similar but hardy species and varieties.

As foundation materials upon which to build new American races, the following wild species appear promising:

RHODODENDRONS: *R. catawbiense, R. maximum, R. caucasicum, R. Smirnovii, R. Metternichii, R. brachycarpum, R. carolinianum, R. minus,* and *R. dahuricum.*

AZALEAS: *A. rosea, A. calendulacea, A. viscosa, A. arborescens, A. nudiflora, A. japonica* (a perfectly hardy pink azalea, formerly confused with *A. mollis*), *A. Kaempferi, A. poukhanensis, A. Schlippenbachii, A. Vaseyi* (synonym: *Biltia Vaseyi*), and *Rhodora canadensis.*

It should be noted that *Rhododendron carolinianum* is one of the best, but its color range is limited to pink and white. Apparently it can be crossed only with great difficulty. The arctic *R. lapponicum* might also be improved if related Chinese species proved good to cross with it.

One reason why the majority of hybrid races now in the trade are not fully satisfactory for American conditions is that some of their ancestors have been species like *Rhododendron ponticum, R. arboreum, Azalea pontica, A. mollis,* and *A. obtusa,* all of which are tender and unreliable for outdoor culture in the north. If distinctly new hybrid races, in which these tender species have no part, can be developed in America, it seems probable that good results will follow. Many wild species of complete hardiness are also of distinct ornamental value. It is probable that most of these can be improved in size, color, and floriferousness by hybridization and selection. In the course of time, therefore, new American races may be produced from these hardy, wild types, which will possess all of the good colors, size, fragrance, and floriferousness of the best of present hybrid races, combined with sufficient vigor and hardiness to resist the cold winters and dry summers of this country.

CLEMENT GRAY BOWERS.

COCOA AND CHOCOLATE[1]

In selecting "Cocoa and Chocolate," as a title for discussion, the speaker stated that he had been influenced by two considera-

[1] Abstract of a lecture given in the Central Display House of Conservatory Range No. 2 of The New York Botanical Garden on Saturday afternoon, February 5, 1927.

tions: (1) The fact that although more cocoa and chocolate is used in the United States than in any other country in the world, very few people here have any idea where it comes from and how it grows; (2) having spent some time in Trinidad, one of the chief cocoa-growing sections of the world, the speaker has had a chance to observe this interesting plant under cultivation and can therefore bring first-hand information on this phase of the subject.

A few weeks ago, in a discussion on the subject of rubber, we learned that Columbus was the first European to have seen this article in use among the Indians. Columbus was not only a great navigator but also a keen observer, and he is also said to have been the first European to have observed cocoa in use as an article of food and drink in the New World. Montezuma, Emperor of Aztecs of Mexico, used large quantities of this product as a drink, but just when or how it was introduced among them is a question which cannot be answered. The use of cocoa was apparently a very old story in the New World when it was discovered by Columbus. From the New World, it was introduced into Europe and its use has gradually spread throughout European countries.

The high esteem in which cocoa and its products were held by the Europeans is indicated by the fact that Linnaeus, who was the first botanist to study this plant in Europe, ascribed to it the name of *Theobroma Cacao,* the name *Theobroma* signifying "Food for the Gods." The name *cacao* was derived from the name employed by the natives of Mexico, where the plant was first discovered by the Europeans. The word cacao has been transformed into the English word cocoa, so that either name may be correctly used.

Cocoa is extensively cultivated in the West Indies, some parts of Mexico, and South American countries. Since my own observations were made in Trinidad, I will confine my remarks to the cultivation as I saw it in that island. In spite of the small size of this island (about thirty-five by forty-eight miles) Trinidad ranks about third in the production of cocoa, the output being exceeded by that of Ecuador and Brazil.

Cocoa grows on trees which scarcely exceed twenty feet in height. The trees are planted about fifteen to eighteen feet apart and, as it requires four or five years for them to come into bearing, fillers are used in the meantime, partly to furnish shade for the young plants and partly in order to get an immediate return

from the soil. Bananas are often used for this purpose, several crops being produced before the cocoa trees begin to yield a return.

One not familiar with this plant is surprised to see the blossoms coming out through the bark of the main trunk and the larger branches, often within a few inches of the ground. After pollination by insects a pod is produced about the size of a cucumber, each pod containing from twenty-five to fifty seeds, embedded in the soft pulp. These are known as the cocoa beans. When they have reached the proper stage of maturity these pods are gathered and after a day or two are cut open with a machete and the seeds removed.

After the process of fermentation, which helps to remove the pulp, the beans are spread out for drying. On the larger plantations drying is done on huge platforms, each one of which is provided with a sliding roof so that they may be covered at night or in rainy weather and exposed to the sun when the conditions are favorable. During the process of drying, it is necessary to keep the beans stirred up in order that they may dry equally on all sides. This stirring process is usually accomplished with the bare feet and a whole family may often engage in the task of shuffling through these drying beans in order to facilitate the process.

When they have reached the proper state of dryness they are piled in heaps and finally put into bags for shipping, each bag weighing 200 pounds. In order to give some idea of the extent of this industry, the speaker said that the small ship in which he returned from Trinidad carried, in addition to other cargo, 19,000 bags of cocoa beans. These represented only one shipment. The process of loading these cocoa beans from the flat boats into the ship is a very interesting one and furnished us several hours of entertainment before we finally sailed.

There are a number of large cocoa factories in the United States, where cocoa is made from this raw material. The first step in the manufacture of cocoa and chocolate is the roasting of the beans. After roasting, they are crushed and the thin shells taken off. The kernel is then broken into a number of small pieces known as nibs. The shells and a part of the embryo which is very hard are discarded leaving the broken pieces of the cotyledons to be used in the finished product. The cocoa nibs are

ground between heavy granite stones, the grinding and heat evolved therefrom resolving them into a thick liquid.

The chocolate liquid is then put under high pressure and a large part of the cocoa butter, which constitutes about 50 per cent. of the seed, removed. The part of the chocolate left after the butter has been removed is known as cocoa. This comes out in the form of hard cakes, which are later ground into a very fine cocoa powder. Sweet chocolate is made by adding powdered sugar to the butter cocoa and pressing into cakes.

The innumerable forms in which cocoa is served, as an article of diet, are too well known to deserve mention. The very high nutritive value of this product renders it one of our most important articles of food and many travelers who are limited for space carry a quantity of sweet chocolate as one of the most condensed forms of food which can be had. The use of cocoa as a drink is increasing rapidly and much more so than that of tea and coffee, and it is well that it should be so, for in addition to its food value it is much less stimulating and does not have the same injurious reactions. The lecture was illustrated by living plants and their edible products.

FRED J. SEAVER.

THE ADDISON BROWN FUND

A bequest of Judge Addison Brown was received by The New York Botanical Garden in January, 1914, subsequent to his death on April 9th of the preceding year. His will provided as follows:

"Out of the residue of my estate (excluding the property referred to in the Eleventh Article), after satisfying the foregoing bequests and charges, I give and bequeath as follows:

(3) To The New York Botanical Garden, I give two hundred shares of the preferred stock of the United States Steel Corporation, to be known as the Addison Brown Fund, the income and accumulations from which shall be applied to the founding and publication, as soon as practicable, and to the maintenance (aided by subscriptions therefor), of a high-class magazine bearing my name, devoted exclusively to the illustrations by colored plates of the plants of the United States and its territorial possessions, and of other plants flowering in said Garden or its conservatories; with suitable descriptions in popular language, & any desirable notes & synonymy, and a brief statement of the known properties & uses of the plants illustrated. The Garden Managers may, from

time to time, change the investment of said fund, as necessary, applying the income to said uses."

Judge Brown was a member of the committee of the Torrey Botanical Club, appointed in November, 1888, to obtain the necessary legislation and primary endowment for The New York Botanical Garden, accomplished in 1895; he made the initial contribution of $25,000 to this endowment; he was one of the original incorporators, a member of the Board of Managers from 1895, and President of the Board from 1910 until his death in 1913.[1] The bequest was subsequently reinvested, and the present principal amounts to $21,149.31, yielding income of about $1,027 annually. The income was accumulated until January, 1916, and publication of the magazine then commenced, under the name *Addisonia*; a volume, in four parts, has since been published annually, the eleventh volume being recently completed; in these eleven volumes, 384 different plants have been illustrated, many of them for the first time. The income of this endowment has been supplemented by sums received from subscriptions and sales, these averaging during the years 1923–1926 about $2,100.00 annually; this added to the income of the fund provides about $3,100 annually for publication. The cost of 32 plates is about $2,600.00 annually; the accompanying letter-press about $800.00, the total cost of the annual volume being thus about $3,400.00. The funds provided for and contemplated by the bequest have thus proved insufficient to defray the entire expense of publication, additional amounts having been supplied from other sources of income.

An edition of 750 copies has been printed, of which about 450 complete sets of the eleven volumes remain on hand. The sale of some sets at $110.00 each would aid the publication at the present time and additional annual subscriptions would be welcomed. The work is a beautiful and instructive addition to any library, and a notable contribution to the illustration and description of plants.

N. L. Britton.

[1] Journal N. Y. Bot. Gard. 14: 119–121. 1913

PUBLICATIONS OF THE STAFF, SCHOLARS, AND STUDENTS OF THE NEW YORK BOTANICAL GARDEN DURING THE YEAR 1926

Alexander, E. J. *Erythronium americanum.* Addisonia 11: 17, 18. *pl. 361.* 13 O 1926; *Azalea viscosa glauca.* 35, 36. *pl. 370*; *Eryngium aquaticum.* 43, 44. *pl. 374*; *Ilex decidua.* 47, 48. *pl. 376.* 9 D 1926.

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NOTES, NEWS, AND COMMENT

Dr. and Mrs. N. L. Britton returned to New York on April 4, after a ten-weeks' visit to Porto Rico.

Dr. Marshall A. Howe, Assistant Director, gave an illustrated lecture on "The New York Botanical Garden and the Schools," before the teachers in the public schools of the City of New York, at the American Museum of Natural History on Wednesday afternoon, March 23.

Mr. Roy G. Pierce, of the United States Department of Agriculture, Washington, D. C., recently spent a day at the Garden, looking over our plantations of pines and other evergreens relative to the work of destructive insects. He also spent some time on the collections of rusts and made notes on the white pine blister rust, preparatory to a revision of our museum exhibit of that fungus.

The conference of the Scientific Staff and Registered Students of the Garden for the month of March was held in the Museum Building on the afternoon of March 2. Dr. Arthur Hollick gave a summary of his studies on "The Flora of the Saint Eugene Silts," which has appeared in print in volume 7 of the Memoirs of The New York Botanical Garden. A progress report on "Fiber Length in Poplars" was presented by Mr. E. J. Schreiner.

A number of models of fleshy fungi have recently been installed in the museum by Dr. Fred J. Seaver. These models were made by Dr. Joshua Rosett, the process being a new one which he himself has devised. It is impossible to display fleshy fungi satisfactorily either by means of dried specimens or those preserved in liquid. There are many different types of models, each of which has its own special advantages. This is the first attempt to install models of living fungi in our museum, and it is hoped that this collection may be added to and improved upon until we have a fairly complete display of these evanescent forms of plant life.

Meteorology for March. The total precipitation for the month was 1.47 inches, including traces of snow. The maximum temperatures recorded at the Garden for each week were 57° on the 5th, 63° on the 13th, *68° on the 17th,* and 52° on the 25th. The minimum temperatures were *16° on the 4th,* 25° on the 11th, 33° on the 16th, and 26° on the 23rd. The ice on the Middle Lake was entirely melted on the 13th.

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GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 35,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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JOURNAL
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CONSTITUTION AND BY-LAWS
REGULATIONS FOR THE OFFICE OF TREASURER
REGULATIONS FOR THE OFFICE OF DIRECTOR-IN-CHIEF
PROVISIONS FOR CONTRIBUTING MEMBERSHIP
PROVISIONS OF THE CHARTER OF THE CITY OF NEW YORK FOR MAINTENANCE

GARDEN VEGETABLES AND HERBS
KENNETH R. BOYNTON

PROFESSOR D. CARLOS SPEGAZZINI, 1858-1926
J. N. ROSE

THE MARIA DEWITT JESUP FUND
N. L. BRITTON

PUBLIC LECTURES DURING MAY AND JUNE

NOTES, NEWS, AND COMMENT

ACCESSIONS

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THE NEW YORK BOTANICAL GARDEN

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JOURNAL
OF
The New York Botanical Garden

VOL. XXVIII MAY, 1927 No. 329

ACT OF INCORPORATION OF THE NEW YORK BOTANICAL GARDEN

AS AMENDED BY CHARTER 103 OF THE LAWS OF 1894, CHAPTER 717, OF THE LAWS OF 1896 AND CHAPTER 473 OF THE LAWS OF 1914

CHAPTER 285

AN ACT to provide for the establishment of a botanic garden and museum and arboretum, in Bronx Park, in the City of New York, and to incorporate The New York Botanical Garden for carrying on the same.

Approved by the Governor April 28, 1891. Passed, three-fifths being present.

The Corporation

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Seth Low, Charles P. Daly, John S. Newberry, Charles A. Dana, Addison Brown, Parke Godwin, Henry C. Potter, Charles Butler, Hugh J. Grant, Edward Cooper, Cornelius Vanderbilt, Nathaniel L. Britton, Morris K. Jesup, J. Pierpont Morgan, Andrew Carnegie, Thomas F. Gilroy, Eugene Kelly, Jr., Richard T. Auchmuty, D. O. Mills, Charles F. Chandler, Louis Fitzgerald, Theodore W. Myers, William C. Schermerhorn, Oswald Ottendorfer, Albert Gallup, Timothy F. Allen, Henry R. Hoyt, William G. Choate, William H. Draper, John S. Kennedy, Jesse Seligman, William L. Brown, David Lydig, William E. Dodge, James A. Scrymser, Samuel Sloan, William H.

Robertson, Stephen P. Nash, Richard W. Gilde
Thomas Hogg, Nelson Smith, Samuel W. Fairchil
Robert Maclay, William H. S. Wood, George M
Olcott, Charles F. Cox, James R. Pitcher, Percy F
Pyne and such persons as are now, or may hereafte
be associated with them, and their successors, a
hereby constituted and created a body corporate b
the name of The New York Botanical Garden, to b

Purposes of the Garden

located in the City of New York, for the purpose o
establishing and maintaining a botanical garden an
museum and arboretum therein, for the collection an
culture of plants, flowers, shrubs, and trees, the ad
vancement of botanical science and knowledge, an
the prosecution of original researches therein and i
kindred subjects, for affording instruction in the sam
for the prosecution and exhibition of ornamental an
decorative horticulture and gardening, and for the en
tertainment, recreation and instruction of the people.

Powers of the Corporation

SEC. 2. Said corporation shall have all such co
porate powers, and may take and hold by gift, gran
or devise all such real and personal property as ma
be necessary and proper for carrying out the purpose
aforesaid, and for the endowment of the same, or an
branch thereof, by adequate funds therefor.

SEC. 3. Said corporation may adopt a constitutio
and by-laws; make rules and regulations for th
transaction of its business, the admission, suspensio
and expulsion of the associate members of said cor
poration, and for the number, election, terms, an
duties of its officers, subject to the provision of thi
act; and may from time to time alter or modify it
constitution, by-laws, rules, and regulations, and shal
be subject to the provisions of Title 3, of Chapter 18
of the first part of the Revised Statutes.

Board of Managers

SEC. 4. The affairs of the said corporation shall b
managed and controlled by a Board of Managers a
follows: The president of Columbia College, th
professors of botany, of geology and of chemistr
therein, the president of the Torrey Botanical Clu

and the President of the Board of Education of the City of New York, and their successors in office, shall be ex-officio members of said corporation and of the Board of Managers, and be known as the Scientific Directors; they shall have the management and control of the scientific and educational departments of said corporation and the appointment of the Director in-Chief of said institution, who shall appoint his first assistant and the chief gardener, and be responsible for the general scientific conduct of the institution. All other business and affairs of the corporation, including its financial management, shall be under the control of the whole Board of Managers, which shall consist of the Scientific Directors, as herein provided, and of the Mayor of the City of New York, the President of the Board of Commissioners of the Department of Public Parks, and at least nine other managers to be elected by the members of the corporation. The first election shall be by ballot, and held on a written notice of ten days, addressed by mail to each of the above-named incorporators, stating the time and place of election, and signed by at least five incorporators. Three of the managers so elected shall hold office for one year, three for two years, and three for three years. The term of office of the managers elected after the first election, save those elected to fill vacancies in unexpired terms, shall be three years; and three managers and such others as may be needed to fill vacancies in unexpired terms shall be elected annually, pursuant to the by-laws of the corporation. The number of elective managers may be increased by vote of the corporation, whose terms and election shall be as above provided; and members may from time to time be added to the Scientific Directors by a majority vote of the Scientific Directors, approved by a majority vote of the whole Board of Managers. The Board of Managers shall elect from their number a President, Secretary and Treasurer, none of whom or of the Board of Managers,

Scientific Directors

Director-in-Chief

Representatives of the City

Elective Managers

Officers

save the Secretary and Treasurer, shall receive any compensation for his services. Nine corporators shall constitute a quorum at any meeting of the incorporators, but a less number may adjourn.

Quorum of the Corporation

SEC. 5. Whenever the said corporation shall have raised, or secured by subscription, a sum sufficient in the judgment of the Board of Commissioners of the Department of Public Parks in the City of New York, for successfully establishing and prosecuting the objects aforesaid, not less, however, than two hundred and fifty thousand dollars within seven years from the passage of this act, the said Board of Commissioners is hereby authorized and directed to set apart and appropriate upon such conditions as to the said Board may seem expedient, a portion of the Bronx Park, or of such other of the public parks in the City of New York north of the Harlem River in charge of the said Department of Parks as may be mutually agreed upon between the said Board of Commissioners and the Board of Managers of said corporation in lieu of Bronx Park, not exceeding two hundred and fifty acres, for establishing and maintaining therein by the said corporation a botanical garden and museum, including an herbarium and arboretum, and for the general purposes stated in the first section of this act. And the said Board of Commissioners is thereupon hereby authorized and directed to construct and equip within the said grounds so allotted, according to plans approved by them and by said Board of Managers, a suitable fire-proof building for such botanical museum and herbarium, with lecture rooms and laboratories for instruction, together with other suitable buildings for the care and culture of tender or other plants, indigenous or exotic, at an aggregate cost not exceeding the bonds hereinafter authorized to be issued by the City of New York; the use of said buildings upon completion to be transferred to said corporation for the purposes stated in this act. And for the purpose of providing means therefor, it shall be the duty of

Original Endowment

Grounds in Bronx Park 250 Acres

Construction of Buildings

the Comptroller of the City of New York, upon being thereto requested by said Commissioners, and upon being authorized thereto by the Board of Estimate and Apportionment, to issue and sell at not less than their par value bonds or stock of the Mayor, Aldermen and Commonalty of the City of New York, in the manner now provided by law, payable from taxation, aggregating the sum of five hundred thousand dollars, bearing interest at a rate not exceeding three and one-half per centum per annum, and to be redeemed within a period of time not longer than thirty years from the date of their issue.

Power of the City to appropriate additional land

SEC. 5-a. The Board of Estimate and Apportionment of the City of New York may, in its discretion, set apart and appropriate, upon such conditions as it may deem expedient, for the extension and development of the work and objects of the said New York Botanical Garden, the whole or any part of that portion of Bronx Park in the city of New York situated between the southern boundary of the land in Bronx Park heretofore appropriated for the use of the said New York Botanical Garden by the Board of Commissioners of the Department of Public Parks, and the northern side of Pelham Avenue; the land so to be appropriated to be described more particularly in the Board of Estimate and Apportionment hereby authorized. (Chapter 473, Laws of 1914.)

Restrictions in use of the grounds

SEC. 6. The grounds set apart, as above provided, shall be used for no other purposes than authorized by this act, and no intoxicating liquors shall be sold or allowed thereon. For police purposes and for the maintenance of proper roads and walks, the said grounds shall remain subject at all times to the control of the said Board of Commissioners of the Department of Parks; but otherwise, after the suitable laying out of the same and the construction of proper roads and walks therein by the Department of Parks, the said grounds and buildings shall be under the management and control of the said corporation. The said grounds

Grounds open and free daily

shall be open and free to the public daily, including Sundays, subject to such restrictions only as to hours as the proper care, culture and preservation of the said garden may require; and its educational and scientific privileges shall be open to all alike, male and female, upon such necessary regulations, terms and conditions as shall be prescribed by the managers of those departments.

SEC. 7. This act shall take effect immediaely.

CONSTITUTION

(Codified to include all amendments made up to and including April 21, 1927.)

ARTICLE I

The provisions of the act of incorporation approved April 28, 1891, as amended by Chapter 103 of the laws of 1894, approved March 7, 1894, are, in pursuance of Section 3 of said act, adopted and form a part of this Constitution.

ARTICLE II

Election of Officers

A President, two Vice-presidents, a Secretary and a Treasurer shall be elected yearly by the Board of Managers from their number in the manner provided by section 4 of the act of incorporation; and the persons so elected shall respectively be the President, Vice-presidents, Secretary and Treasurer of the Board of Managers and of the corporation. There shall also be elected an Assistant Secretary and an Assistant Treasurer, who need not be members of the Board of Managers. Vacancies in either of said offices may be filled by the Board of Managers until the next annual election.

ARTICLE III

Appointment of committees

The Scientific Directors and the Board of Managers may respectively appoint such other persons and such committees to aid in the performance of the duties and business of their respective departments as they shall deem best.

ARTICLE IV

Adoption of By-Laws, Rules and Regulations

The Scientific Directors and the Board of Managers are each authorized to adopt such by-laws, rules and regulations in their respective departments as shall be approved by them respectively, and also to change or amend the same from time to time; and the same when so adopted by them shall be deemed the by-laws, rules and regulations of the corporation.

ARTICLE V

Associate Members

Associate members may be admitted, suspended or expelled in the manner provided for by the rules adopted by the Board of Managers.

ARTICLE VI

Patrons, Life Members, Annual Members

Benefactors, Patrons, Fellows-for-Life, Fellowship Members, Sustaining Members, Life Members and Annual Members may be created by the Board of Managers and admitted upon the payment of such sums as shall be approved and established by the Board.

ARTICLE VII

Amendments to Constitution

Amendments to this Constitution not incompatible with the act of incorporation may be made by a vote of four-fifths of the members present at any regular meeting of the incorporators, or at any special meeting called for the purpose by the Secretary, upon the direction of the President, on ten days' prior notice by mail of such meeting and of the proposed amendments.

BY–LAWS

(Codified to include all amendments made up to and including April 21, 1927.)

I

Annual Meeting of the Corporation

The annual meeting for the election of managers and of additional members of the corporation shall be held in the City of New York on the second Monday in January. A notice of such meeting shall be mailed by the Secretary to each member of the corporation at least ten days previous. The number of elective

managers may be increased, and vacancies in unexpired terms may be filled, by vote of the corporation at any annual meeting, and also at any special meeting called upon the recommendation of the Board of Managers, upon like notice, and with notice of the proposed increase.

II

President and Vice-president

At all meetings of the corporation and of the Board of Managers, the President shall preside; or, in his absence, one of the Vice-presidents. The President or either Vice president is authorized to approve bills of the Garden against city maintenance appropriations.

III

Meeting of the Board of Managers

The managers shall hold an annual meeting on the second Monday in January, following the annual meeting of the corporation. Other regular meetings of the managers shall be held on the third Thursdays of April, June, and November. Special meetings may be held by direction of the President, or, in his absence, by the direction of either Vice-president.

IV

Quorum of the Board of Managers

Five managers shall constitute a quorum at any meeting of the Board of Managers, providing that not more than two are Scientific Directors.

V

Committees

Committees of the Board of Managers, to be appointed by the Board at each annual meeting, shall include:

An Executive Committee,
A Finance Committee,
A Membership Committee,
A Committee on Endowment.

Special committees may be appointed at any meeting, and may be composed of managers, of members of the corporation, or of both.

VI

Executive Committee

The Executive Committee shall consider all matters referred to it at meetings of the Board of Managers or of the Corporation and report at subsequent meetings, and shall annually nominate managers, officers, and additional members of the corporation. It shall consist of seven members, including the President, Treasurer, and Secretary. The Committee shall annually elect a chairman.

VII

Finance Committee

The Finance Committee shall advise the Treasurer concerning investments and reinvestments of permanent funds, and shall have charge of such real estate as may become the property of the Corporation. It shall consist of three members, and the Treasurer *ex-officio*.

VIII

Membership Committee

The Membership Committee shall consist of three members and shall issue invitations for Annual Members, Sustaining Members, Fellowship Members, Fellows for Life, Patrons, and Benefactors.

IX

Endowment Committee

The object of the Committee on Endowment is to increase permanent funds; it shall consist of the President, Treasurer, Secretary, and four other members of the Board of Managers.

X

Treasurer

The Treasurer shall collect, receive, and disburse the funds of the Corporation as directed by the Board of Managers. He shall invest and reinvest all permanent funds as advised by the Finance Committee. He shall report to the managers at all stated meetings.

Xa

Assistant Treasurer

The Assistant Treasurer shall perform all duties of the Treasurer during the latter's absence or disability.

Secretary

XI

The Secretary shall give notice of all meetings of the corporation, of the Board of Managers and of the Executive Committee, and shall take and preserve the minutes thereof; he shall have the custody of the seal, and shall perform such other duties as may be directed by the corporation, the Board of Managers, or the Executive Committee.

XIa

Assistant Secretary

The Assistant Secretary shall perform all duties of the Secretary during the latter's absence or disability.

Quorum of Scientific Directors

XII

A majority of the Scientific Directors shall constitute a quorum at any meeting.

XIII

Officers of Scientific Directors

The Scientific Directors shall elect a Chairman and Secretary, who shall hold office until their successors are elected, and perform the duties which usually pertain to these offices.

XIV

Meetings of Scientific Directors

Regular meetings of the Scientific Directors shall be held on the second Saturdays of April, June, October, and December, and special meetings may be held pursuant to call by the Chairman.

XV

Advisory Council

The Advisory Council shall be composed of women. It shall consist of Honorary Members chosen in recognition of noteworthy service to the Garden, to be elected by the Board of Managers from time to time to serve at the pleasure of the Board, and at least twelve active members to be elected by the Board at its annual meeting to serve until the next annual meeting of the Board. Additional active members, upon nomination of the Council, may be elected by the Board at any meeting to serve until the next annual meeting of the Board.

The Council may make proposals to the Board of Managers in regard to the improvement and development of the Garden, may arrange social functions, and may act in other matters that may be referred to it by the Board.

XVI

Elections to be by ballot

The election of managers and of additional members of the corporation shall be by ballot. All other votes at meetings may be taken *viva voce,* unless a ballot be demanded by some member, whereupon the vote shall be taken by ballot.

XVII

Amendments to By-Laws

Amendments to the By-Laws may be made at any meeting by a vote of a majority of the entire Board of Managers and by the unanimous vote of a quorum.

REGULATIONS FOR THE OFFICE OF TREASURER

The Treasurer shall have the custody of the corporation's funds and securities.

He shall have supervision and direction over all receipts and disbursements of the corporation and of its books of account and of forms and blanks relating to accounts used in any department.

He shall cause to be kept full and accurate accounts of all financial transactions in books belonging to the corporation.

He shall deposit all moneys in the name and to the credit of the corporation in such depositories as shall be designated from time to time by the Board of Managers or the Executive Committee.

He shall disburse the funds of the corporation as may be ordered by the Board of Managers or the Executive Committee, taking and preserving the proper vouchers for such disbursements.

He shall render to the President or the Board of Managers or the Executive Committee, whenever requested, an account of his transactions as Treasurer and of the financial condition of the corporation, and as soon as practicable after the close of each fiscal year he shall make and submit to the Board of Managers a like report for such fiscal year.

The Treasurer may require, from time to time, from any officer, agent or employee of the corporation, reports or statements giving such information as he may request with respect to any financial transaction of the corporation.

An Assistant Treasurer may be appointed by the Board of Managers or the Executive Committee. He shall have powers to perform such duties as shall at any time be delegated to him by the Board of Managers or the Executive Committee or the Treasurer.

REGULATIONS FOR THE OFFICE OF DIRECTOR-IN-CHIEF

1. The Director-in-Chief is the Executive Officer of the Garden, and is responsible to the Board of Managers, and to the Scientific Directors, for the general management and control of all its departments.

He shall promptly and efficiently carry out all their regulations and directions, and be responsible for the proper maintenance and good order of the buildings and grounds.

2. He may from time to time make recommendations for the development and management of the Garden in all its departments, including the laying out of the grounds, the construction of buildings and the conduct of the museums, the herbarium or any of the departments of the Garden, accompanying the same by his estimate of the probable cost therefor.

3. He shall recommend the employment of such persons as shall be needed for the various departments of the Garden and have power to remove all employees, except those upon a yearly salary. All such salaried employees he shall have power to suspend, and, on approval of the appropriate committee or board, to discharge.

4. He shall make all necessary purchases of tools, implements, and supplies for the Garden as authorized, and shall be responsible for the proper inventory, care, and use of the same.

5. He shall examine, correct, and certify all bills incurred under his management, and shall keep, in books provided for that purpose, an accurate account of his expenditure of all appropriations made for Garden purposes, which books, together with proper vouchers, shall at all times be open to inspection by members of the Board.

6. He shall keep a copy of his official correspondence.

7. He shall use diligent efforts to build up the Garden Herbarium, the Library and the Museum, and the collections of living plants and trees, by correspondence, by exchanges of duplicates not needed, and by purchase, so far as means therefor are placed at his disposal.

8. He shall report to the Board of Managers, the Scientific Directors, or special committees, in such manner and at such times as they may direct.

9. He shall make no expenditures and incur no liabilities, except under appropriations made by the Board.

10. He shall devote his whole time and energies to the promotion of the Garden interests, and shall not engage in any outside work except with the approval of the Board or the Executive Committee.

PROVISIONS FOR CONTRIBUTING MEMBERSHIP

1. *Benefactors.*––The contribution of $25,000.00 or more to the funds of the Garden by gift or by bequest entitles the contributor to be a benefactor of the Garden.

2. *Patrons.*—The contribution of $5,000.00 or more to the funds of the Garden by gift or by bequest shall entitle the contributor to be a patron of the Garden.

3. *Fellows for Life.*—The contribution of $1,000.00 or more to the funds of the Garden at any one time shall entitle the contributor to be a fellow for life of the Garden.

4. *Fellowship Members.*—Fellowship members pay $100.00 or more annually and become fellows for life when their payments aggregate $1,000.00.

5. *Sustaining Members.* -Sustaining members pay from $25.00 to $100.00 annually and become fellows for life when their payments aggregate $1,000.00.

6. *Annual Members.*—Annual members pay an annual fee of $10.00. All members are entitled to the following privileges:

1. Tickets to all lectures given under the auspices of the Board of Managers.

2. Invitations to all exhibitions given under the auspices of the Board of Managers.

3. A copy of all handbooks published by the Garden.
4. A copy of all annual reports and Bulletins.
5. A copy of the monthly Journal.
7. *Life Members.*—Annual Members may become Life Members by the payment of a fee of $250.00.

Form of Bequest.—I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of .....

PROVISIONS OF THE CHARTER OF THE CITY OF NEW YORK FOR MAINTENANCE

§ 1613. It shall be the duty of the commissioner for the boroughs of Manhattan and Richmond to maintain the meteorological and astronomical observatory, the Museum of Natural History, the Metropolitan Museum of Art in Central Park, the Aquarium in Battery place, and such other buildings as now are or may hereafter be erected in such parks or in any other park, square or public place under his jurisdiction by authority of the board of aldermen. It shall be the duty of the commissioner for the boroughs of Brooklyn and Queens to maintain the Brooklyn Institute of Arts and Sciences, and such other buildings as now are or may hereafter be erected in any park, square or public place under his jurisdiction by authority of the board of aldermen. It shall be the duty of the commissioner for the borough of The Bronx to maintain The New York Botanical Garden and the buildings appurtenant thereto, and such other institutions or buildings as may be established or erected in any park, square or public place in his jurisdiction by authority of the board of aldermen. It shall be the duty of the several commissioners to provide the necessary instruments, furniture, and equipments for the several buildings and institutions within their respective jurisdictions, and, with the authority of the board of aldermen, to develop and improve the same, and to erect additional buildings; but the maintenance of all such buildings and institutions shall be subject to the provisions of the acts incorporating said institutions, or either of them, and the acts amendatory thereof, and to the powers of said corporations thereunder, and of the boards by such acts created or provided for; and shall also be subject to and in conformity with such contracts and agreements as have heretofore been made with

such institutions respectively, and are in force and effect when this act takes effect, or as may be hereafter made by the authority of the board of aldermen, and no moneys shall be expended for such purposes unless an appropriation therefor has been made by the board of estimate and apportionment and the board of aldermen. Out of the moneys annually appropriated for the maintenance of parks each commissioner may apply such sum as shall be fixed by the board of estimate and apportionment for the keeping, preservation, and exhibition of the collections placed or contained in buildings or institutions now situated or hereafter erected in the parks, squares, or public places under the jurisdiction of such commissioner.

§625. The commissioner for the borough of The Bronx is hereby authorized and directed to carry out the existing contract made by and between the department of parks of the corporation heretofore known as the mayor, aldermen, and commonalty of the city of New York and the board of managers of the corporation known as The New York Botanical Garden pursuant to the provisions of chapter two hundred and eighty-five of the laws of eighteen hundred and ninety-one, entitled " An act to provide for the establishment of a botanic garden and museum and arboretum in Bronx park in the City of New York and to incorporate The New York Botanical Garden for carrying on the same," as amended by chapter one hundred and three of the laws of eighteen hundred and ninety four, which contract provides for the alloting and setting apart for the uses of said garden of two hundred and fifty acres of land or less in the northern part of Bronx Park as shown upon a certain map thereof numbered five hundred and sixty-eight, and signed by Messrs. Vaux and Parsons, and filed with the former department of public parks of the corporation known as the mayor, aldermen and commonalty of the City of New York.

GARDEN VEGETABLES AND HERBS[1]

Vegetables and herbs are closely connected with man's history. Movements of peoples have accounnted for the histories of many

[1] Abstract of a lecture given in the Central Display House of Conservatory Range No. 2, on Saturday afternoon, January 15, 1927.

economic plants, and the tastes of tribes have furnished the reason for the domestication of wild plants, and their visits to other nations have resulted in the interchanging of foods and the gradual extension of food plants. There is an astonishing number of widespread and ancient economic plants whose original home is still not definitely known; and others whose histories are obscure. About some of these the botanist and anthropologist now stand corrected. The white potato was not taken to Great Britain by Raleigh from North America, nor by Hawkins, nor by Drake. It was not found here when the colonists first settled. That "potato" was the little groundnut, *Apios*. The "Irish" potato did come from South America to Europe through the Spaniards, thence to Ireland; and, as Safford, who draws these conclusions, infers, thence from Londonderry to Londonderry, N. H., as the "Irish" potato. The wild species *Solanum tuberosum* has not yet been found but is generally credited to the Andean region.

Botanically one of the most interesting groups is that of the Cabbage. Kale, Brussels Sprouts, Savoy Cabbage, Cabbage, Red Cabbage, Collards, Kohl-rabi, Cauliflower, and the Broccoli, newly popular in America, are varieties of one species. Turnips are of a closely related species, which may be found growing wild in Russia and Siberia. Beets, which are modern, except in a medicinal way, are derived from a plant growing naturally in parts of Europe and North Africa.

Who is not familiar with the Queen Ann's Lace or the Wild Carrot? Vilmorin in three years developed from the wild form plants with roots as large and edible as the cultivated varieties of carrot, proving that this plant was the origin of our to-day almost indispensable vegetable. Carrots were eaten by the ancients, but were not such favorites as they are to-day. They were common in the sixteenth century in China, and were probably cultivated long before that. Botanists claim that most types of the carrot may perhaps be found in nature. Thus it is one of the vegetables most easily adapted as a food of man.

Lettuce, our best salad, is one of the oldest. Five hundred years before the Christian era it was eaten. Aristotle praised it highly, and the Romans had named varieties of lettuce in the first century. It is a member of the chicory family, related to the dandelion and the endive. The last-named vegetable is of uncer-

tain origin. It has been said by some to be wild in India, by others in Sicily. As with many of the vegetables, the long and widespread cultivation since the Egyptian glory has obscured any history of its origin. The Greeks and Romans did not know spinach, and it was new to the northern Europe of the sixteenth century, but, on the other hand, it was introduced into China from Persia 100 years B. C. It looks as if the Greeks and Romans did not like it, but southern Europe probably appreciated and grew spinach some time before the northern countries. Water Cress, growing naturally in all North Temperate regions, has been eaten as a salad since the Greek and Roman ascendancy and it has been cultivated since the sixteenth century.

Peas were used by the ancient Egyptians and others, but were not common food in Europe until the 18th century. They were probably grown in the earliest American settlements and nearly one hundred varieties were described by the New York Agricultural Experiment Station in 1884.

In the Tomato, on the other hand, we have a vegetable from the western side of the world. While the first cultivation dates for England are around 1596, it was used only as a curiosity or in soups before 1750, and had only become common in northern England in 1830. The tomato was grown earlier in warm countries. Matthiolus mentioned it as being in Italy around 1550. Thomas Jefferson recorded the growing of tomatoes in Virginia in 1781, yet it is said that an Italian could not persuade the people of Salem, Massachusetts, to taste the fruit in 1802. But the "love apple" or "gold apple" of the herbalists soon after began to appear as a market vegetable. In the early part of the 18th century the tomato was a subject of general field culture in Italy and it is to the people of that country that we must accord its highest and earliest appreciation. Rosemary is a plant of the mint family, used for flavoring. It was mentioned in 1475 as a seasoning herb for salted meat, and was accorded many virtues in the older herbals. Sage, which is a native of the Mediterranean regions, has been cultivated since remote times, not only as a seasoning herb but also for its medicinal value. Thyme, from southern Europe, was domesticated in many countries after 1850. Fennel was grown by the Romans and used to season meats and sauce, and spread rapidly with the various civilizations. Foliage

and seeds in various varieties have been used for seasoning, and the enlarged leafstalks of the Florence Fennel, favored in Italy, are used as a food.

Sweet Basil, a seasoning herb which is grown on thousands of window sills of New York City, comes from tropical Asia, and is a very ancient herb. Parsley, which the great physician Galen praised as a food, was used for decorating the dishes of the Greeks and Romans, much as it is used now. It always possessed magic seasoning properties; man has improved it only by intensifying the crisp and curl of the leaves.

Growing examples of some vegetables and herbs, some of the wild forms and historic pictures of early kinds, were exhibited to the audience.

KENNETH R. BOYNTON.

PROFESSOR D. CARLOS SPEGAZZINI, 1858–1926

Some months ago numerous botanists in this country received the announcement from Argentina of the death of Carlos Spegazzini, which occurred July 1, 1926. Professor Spegazzini was the most distinguished botanist of Argentina, and perhaps the most prominent of all the botanists who have lived in South America. He was born in Italy in 1858, but went to Argentine some forty-five years ago. From this time forward he was identified with the botany of Argentine. During this period he published more than 100 papers[1] on botanical subjects, chiefly on plants of his adopted country. He had a wide interest in all botanical lines: he was an authority on the Fungi and made valuable contributions on the obscure group Laboulbeniaceae; he was also an authority on grasses and on the Cactaceae, in which group he described many new species from the Argentine.

Personally he was a very delightful man, active, enthusiastic, helpful. His home was at La Plata, some 40 miles distant from Buenos Aires. This was the Mecca of all botanists who visited Argentine. I shall never forget my visits with him, while engaged in studying the Cacti of South America, in 1915. He could not do too much for me; he shared with me all his rare types and

[1] A list of his botanical papers compiled by A. C. Scola was published in the Anales de la Sociedad Cientifica Argentina 88: 243–250

loaded me down with a trunk of glass negatives, which I must take back to Washington and use. While connected with the government service he had brought together a wonderful collection of living Cacti, of which he was very proud. One of the attractive displays was a hedge, two squares long, made of *Pereskia Pereskia*. It is indeed an ideal hedge plant for tropical countries; it grows very compactly and is as formidable as the osage-orange. It must be very beautiful when in flower, covered with its large white blossoms. He was also very eager to show me a type plant of an Opuntia, which he had brought home from one of his excursions. One can imagine his mortification, disgust, and anger, on reaching the spot where it had been planted, to find it was gone. On inquiry, he learned it had been recently uprooted, along with his other plants, by a new administration, and had been taken off to the common dump. Fortunately for me he was able to find a few pads, which he gave me, these being the last of the type plant.

I shall never forget my last interview with him. Our ship was to sail for New York from La Plata, and I had shipped all my baggage from Buenos Aires to that place, and had written Professor Spegazzini when we were to sail. A few minutes before we were to go aboard, he appeared on the dock, cheerful, and enthusiastic as ever, carrying under his arm a package of choice cactus specimens, which he had overlooked the week before when I called on him. His passing is a distinct loss to the scientific world.

J. N. Rose.

THE MARIA DEWITT JESUP FUND

The will of Mrs. Maria DeWitt Jesup, widow of Mr. Morris K. Jesup, admitted to probate June 21, 1914, provided a bequest of $25,000 for The New York Botanical Garden. Many other institutions were also included in this will, all under the following conditions:

"Ninth: As to all legacies herein bequeathed to and for the benefit of institutions of whatsoever kind, I direct that the same shall in each case constitute a permanent fund (except as I have specially provided otherwise), the principal to be invested and kept invested and called the 'Morris K. or Maria DeWitt Jesup

Fund,' the income to be applied and appropriated, except where I have made other special provisions, to the general purposes of the institutions respectively, other than alterations, additions, repairs or erection of buildings and purchase of land or the payment of debts, and also other than the payment of salaries to executive and other officers."

At the meeting of the Board of Managers on April 15, 1915, the income of this bequest was designated for the increase of the collections of plants, books, or specimens.

At the meeting of June 17, 1915, the following resolution was adopted:

"*Resolved:* That the legacy of Mrs. Maria DeWitt Jesup be and it hereby is designated 'The Maria DeWitt Jesup Fund,' in accordance with the requirement of the Ninth Clause of Mrs. Jesup's will."

This bequest was paid over in three instalments, during 1915, 1916, and 1917. The annual income is about $1,200. The first appropriation of income was made in 1915, and appropriations have since been made annually and expended for the purposes specified.

This fund has operated to increase materially the collections of plants, books, and specimens; on several occasions it has provided means for the purchase of rarities. While the income is not large enough to cover all needs, it has been very helpful.

Mrs. Jesup was an annual member of the Garden from 1905 until her death in 1914.

N. L. Britton.

PUBLIC LECTURES DURING MAY AND JUNE

The following is the program of the illustrated lectures for May and June. They are given in the Museum Building of The New York Botanical Garden on Saturday afternoons, beginning at 4 o'clock. Doors are opened at 4:15 to admit late-comers.

May 7. "Tulips." Mr. Kenneth R. Boynton.

May 14. "The Present Status of Evolution." Prof. Henry C. Cowles.

May 21. "Irises for the Home Garden." Mrs. Wheeler H. Peckham.

May 28. "New Varieties of Old Perennials."
Prof. Alfred C. Hottes.
June 4. "Relation of Soils to Plant Growth." Dr. B. A. Keen.
June 11. "Louis Pasteur." Dr. Israel Weinstein.
June 18. "Botanizing in the Mountains of Colorado."
Dr. F. J. Seaver.
June 25. "The Plant Life of the Sea." Dr. Marshall A. Howe.

NOTES, NEWS, AND COMMENT

About 600 members of the biology classes of the Evander Childs High School visited the Garden on the morning of Saturday, March 26, and about 300 from the Theodore Roosevelt High School in the forenoon of Saturday, April 2. After an inspection of living plants of special biologic and economic interest in Conservatory Range No. 1, an illustrated lecture on forestry was given by Mr. George T. Hastings, head of the biology department of the Theodore Roosevelt High School.

Many plants bloomed in the Garden this year before the first of April. In addition to the usual Witch Hazels, Willows, Snowdrops, Hazels, and Alders, the following were seen in bloom from time to time during March: Fragrant Bush Honeysuckle, Forsythia, Shrub Yellow Root, Alpine Rock Cress, Corylopsis, *Iris reticulata,* Azure Hyacinth, Spring Heath, Green Hellebore or Christmas Rose, *Bulbocodium vernum,* Eranthis or Winter Aconite (three kinds), Squills in variety, Bush Jasmine, David's Peach, pink and white forms, and Tulips in close proximity to the greenhouse.

Dr. Arthur Hollick attended the joint meeting of the Southern States Art League and Southern Museums Conference, at Charleston, S. C., on Thursday, April 7, to Saturday, April 9. The meeting was specially planned to encourage art and the museum idea in the Southern states, and to organize for mutual cooperation and assistance. Delegates from museums located in the Southern states and representatives from museums elsewhere in the United States were guests of the Charleston Museum. Automobile trips were provided for visits to points of historical interest in Charleston, and to the celebrated Magnolia Gardens and Middleton Place, where the azaleas and wisteria were just at their best.

At the regular monthly Conference of the Scientific Staff and Registered Students of The New York Botanical Garden, April 6, 1927, a paper entitled " Morphology of the Pollen Grain in relation to the Classification of *Vernonia*" was read by Mr. R. P. Wodehouse. He showed that the extremely complicated patterns found in the pollen grains of this genus could be resolved into certain simple elements which occur in various combinations in the different species. A comparison of these forms with each other showed that the difference in relationship expressed in Gleason's classification of the Genus *Vernonia* in the North American Flora is generally supported. This paper is an extension of the work reported by Mr. Wodehouse at the Conference on December 2, 1925. The details of the paper will shortly be published elsewhere.

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BRONX PARK, NEW YORK CITY

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FURTHER BOTANICAL STUDIES IN PORTO RICO
N. L. BRITTON

THE PALMETTO-PALM—SABAL TEXANA
JOHN K. SMALL

TULIPS
KENNETH R. BOYNTON

THE FANNY BRIDGHAM FUND
N. L. BRITTON

NOTES, NEWS, AND COMMENT

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FURTHER BOTANICAL STUDIES IN PORTO RICO

TO THE SCIENTIFIC DIRECTORS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: By permission of the Board of Managers, I was absent from the Garden, accompanied by Mrs. Britton, during the period January 20 to April 4, 1927, engaged in continuation of studies of the botany and horticulture of Porto Rico, as a part of the Scientific Survey of Porto Rico and the Virgin Islands prosecuted by the New York Academy of Sciences, the results of which are now in course of publication.

Four volumes of the reports of this Survey, each of four parts, have been assigned to plants (Volumes V–VIII) of these, Volume V, published in four parts, and the first three parts of Volume VI (1924–1926) contain a Descriptive Flora of the Seed-bearing Plants (Spermatophyta) written by me with the assistance of Percy Wilson, and of the Ferns and Fern-allies (Pteridophyta) by Dr. William R. Maxon; the fourth part of this Volume VI is reserved for the Mosses and Moss-allies (Bryophyta); the investigation is in progress by Elizabeth G. Britton and Professor Alexander W. Evans. Of Volume VII, the first two parts, dealing with the Plant Ecology of Porto Rico, written by Dr. H. A. Gleason and Dr. Mel T. Cook, have recently been published (1927); part 3, reserved for Palaeobotany, written by Dr. Arthur Hollick, is nearly complete for publication; part 4 is reserved for Economic Botany, under its subdivisions Agriculture, Horticulture, Pharmacology, and Forestry, for contribution by Commissioner Carlos E. Chardon, Otis W. Barrett, Dr. H. H. Rusby, and William P. Kramer. Of Volume VIII, Part I (1926), Mycology of Porto Rico and the Virgin Islands, enumerates the Fungi and

Slime-moulds, written by Dr. Fred J. Seaver and Commissioner Chardon, with contributions by Professor H. H. Whetzel, Professor Frank D. Kern, and R. A. Toro; parts 2 and 3 are reserved for Lichenology, in preparation by Professor Bruce Fink, and Phycology (Algae), in preparation by Dr. Marshall A. Howe, Professor Nathaniel L. Gardner, Dr. H. Printz, and Mr. Robert Hagelstein; supplementary matter and an index to the four volumes of botanical documents will form part 4 of this volume.

Interrelations of plants and animals have been given much attention by several investigators during the progress of the Survey; in order to increase this knowledge and at the same time contribute to Entomology, Charles W. Leng, Director of the Staten Island Institute of Arts and Sciences, accompanied us for about five weeks, for further studies of beetles (Coleoptera). To facilitate this investigation, we selected typical plant associations in many parts of Porto Rico, from sea-level to the mountain summits, determining the food-plants of beetles and their ecology; Mr. Leng detected a number of species hitherto unrecorded from Porto Rico, some of them new to science and undescribed.

Hoping to increase knowledge of the extinct vegetation of Porto Rico, we spent much time in seeking fossil plants in the older rocks in the vicinity of Aibonito, where fragmentary specimens were found by Geologist E. T. Hodge about ten years ago, and recorded by him (Scientific Survey, Vol. I. p. 192). Architect Anton Nechodoma and Engineer W. D. Noble, of San Juan, joined us in this search, and although we examined several tons of rock at several points in the area indicated by Mr. Hodge, we failed to find any recognizable plant fossils. Definite information about the Mesozoic flora of the West Indies must await further discovery. On the other hand, Dr. Hollick's study of the large collection of Tertiary plant fossils made by us last year at the Collazo River, gives us much knowledge of the vegetation of the Oligocene Period in Porto Rico, soon to be published.

Visits were made to known localities for several of the rarer living trees; the deforestation of the region has sadly reduced the number of some of the kinds of trees, among them some of high value. The Pimienta angola (*Anamomis*) of the Myrtle Family is known, for example, only in one individual, a fine large tree

FIGURE 1. Photograph of a mahogany tree planted in 1905 in the plaza of Bayamon, Porto Rico, in honor of Dr. Agustin Stahl, distinguished naturalist. (Taken by Enrique Verges, of Bayamon.)

standing in the forest of Miss Clara Livingston at Sardinera on the northern coast; Cobana negra (*Stahlia monosperma*) of the Cassia Family is apparently confined to three colonies, two small ones near together on the eastern coast near Ceiba, the other, larger, near the western coast near Boqueron; Palo pollo (*Pterocarpus*) of the Pea Family is now known only in swampy woods near the Playa de Humacao, where it has recently been much reduced by lumbering; several mountain trees have not been observed at all in recent years and may be eliminated. The operations of the Forest Service are tending to restore much needed woodlands to Porto Rico, but its officers have not, as yet, been provided with the areas, nor the means requisite for this work, all important for the welfare of the colony; in the nurseries of the Forest Service at Rio Piedras, over three hundred kinds of trees have been brought together for experimental purposes.

Studies were made of the planting in several of the plazas of Porto Rico cities, some of them elegant and well maintained; the plaza of Guayama is one of the best, and here the preservation of plants is implored by numerous wooden sign-boards, worded in Spanish of high originality by Pharmacist Bruno of that city, and erected by the municipality; a translation of one of these recites, "The plants are unable to defend themselves; therefore do not attack them." The luxuriance of the vegetation would indicate that Señor Bruno's effort has not been in vain.

In the plaza of Bayamon, the planting is simple, of trees only, but one of these trees is noteworthy, perhaps the most highly esteemed one in Porto Rico; it is protected by a low concrete wall, bearing a tablet with a Spanish legend which, translated, records "This mahogany tree was planted in 1905 in honor of the distinguished Porto Rican naturalist, Agustin Stahl" [FIGURES 1 and 2]; it is now about thirty feet high. Dr. Stahl was a medical practitioner at Bayamon from 1865 until his death in 1917; during this period he made important studies of plants, animals, and aboriginal implements; he published a book, now very rare, entitled "Estudios sobre La Flora de Puerto Rico" (1883–1888).

Additional species brought into the nurseries of the Forest Service, the Agricultural Experiment Stations, and the Department of Agriculture during 1926 were observed with interest and appreciation, and private gardens were cordially thrown open for

our studies by their owners. We spent two days with President J. W. Harris and Mrs. Harris at the Polytechnic Institute of Porto Rico at San German and discussed with them their interesting proposition to establish a tropical arboretum on the Institute grounds; I have outlined for them a tentative scheme for grouping the trees to be planted, with reference to the kinds already there.

We were guests on two occasions of Mr. Emilio M. Verges, 2nd, at Maunabo, and from this estate as a base, conveniently visited interesting points on and near the southern coast, among them the old garden of the late Mr. Lind, near Arroyo, where some fine old trees remain, among them the largest and oldest mahoganies existing in Porto Rico; these bore an enormous crop of fruit, just ripe, which was soon afterward collected by Forest Chief W. P. Kramer to obtain the seeds, much desired for forestry purposes; mahogany is not native in Porto Rico, and seeds previously planted by the Forest Service were only obtained from other islands, with considerable loss; this readily available source of seed is certain to be of importance in the work of reforestation.

Examination of the many water-color paintings recently made of Porto Rico flowering plants by Mrs. Frances W. Horne, formerly at Mayaguez, now at Santurce, gave us much pleasure, and we selected twelve of them for reproduction in *Addisonia,* additional to those already published in that journal; her collection of these paintings, now including over one hundred and twenty species, was exhibited one afternoon to the biology class of the University of Porto Rico and visitors, under the direction of Professor and Mrs. Dexter, and on this occasion I addressed the meeting, with especial reference to the species endemic in Porto Rico, and to the accuracy and beauty of Mrs. Horne's talented work.

Visits to the new School of Tropical Medicine at San Juan, conducted in coöperation with Columbia University, were of great interest, and especially demonstrations there by Dr. Ashford of his noteworthy investigations of the minute fungi inhabiting the human digestive organs; at a meeting of students and visitors held at this school, under the chairmanship of Dr. Lambert, I outlined the present status of the Scientific Survey of Porto Rico and the Virgin Islands.

FIGURE 2. Detail of the base and tablet of the mahogany tree planted in the plaza of Bayamon as a memorial to Dr. Agustin Stahl. See also FIGURE 1.

Two visits were made to the United States Agricultural Experiment Station and to the College of Agriculture and Mechanic Arts at Mayaguez; we are indebted to Mr. D. W. May, Director of this station, and Mrs. May, to Mr. T. B. McClelland, horticulturist, and his mother, and to Professor H. T. Cowles, Acting Dean of the College, and Mrs. Cowles, for information and hospitality.

It was my privilege to discuss with his Excellency, Governor Towner, and with many men of science and other citizens, a recent proposition for the establishment and maintenance of a new investigational School of Tropical Agriculture, and the availability of Porto Rico as a locality for such an institution; its almost exclusively agricultural industries, with soils of great diversity, wide differences of rainfall in different areas, elevations from sea-level to over four thousand feet, and its easy accessibility from all other parts of America were cited as paramount advantages.

A request by Don Miguel Colon, manager of the Coamo Springs Hotel, for information about the trees growing on the grounds of the hotel, to enable him to answer many inquiries by guests, led up to my writing brief accounts of them, for printing in Spanish and in English, as a pamphlet for distribution; numbers were affixed to one or more trees of each kind, and the accounts numbered to correspond, a method of giving information suggested by Mr. Anton Nechodoma. The translation into Spanish has been made by Mrs. John Smith Dexter, University of Porto Rico.

In continuation of previous studies of the natural vegetation and of plants introduced for economic and aesthetic purposes we collected material of about four hundred species, including about two thousand specimens, obtaining many duplicates for exchange with other institutions.

Respectfully submitted,

N. L. Britton,

Director-in-Chief.

THE PALMETTO-PALM—SABAL TEXANA

(WITH TEXT FIGURES 3–5)

Rio de las Palmas was the first name for the international river now called the Rio Grande. This name occurs on an early Spanish map (Cantino, 1502) of North America, perhaps the first made. The name, evidently, was suggested to the navigator by the groves of palm trees along its banks. By this evidence, although indirect, we may safely assume that this palm—*Sabal texana*—was the first palm seen by a European on the North American mainland.

Only four arborescent palms occur in the continental United States outside of Florida, (1) the cabbage-tree (*Sabal Palmetto*) of our southeastern Atlantic region, (2) the delta-palm (*Sabal Deeringiana*) of the Mississippi River delta, (3) the fanleaf-palm (*Neowashingtonia robusta*) of the southern Californian deserts, and (4) the Texas cabbage-tree or palmetto-palm (*Sabal texana*). The fourth one remained undiscovered at least from a botanical standpoint, for nearly or quite three centuries after its relative of the Atlantic seaboard and that of the Pacific slope were well known, and extensively cultivated.

Apparently the first note of importance that appeared in reference to the Texas cabbage-tree was written by Arthur V. Schott.[1]

[1] Arthur Carl Victor Schott was born 27 February, 1814, at Stuttgart, Württemberg. He was educated in his native city, and at the institute of agriculture in the neighboring village of Hohenheim. He then managed various estates in Germany, and was for ten years in charge of a mining property in Hungary. In 1848 he traveled through southern Europe, Turkey, and Arabia. In 1850, already an accomplished linguist, artist, and naturalist, he came to America, where he almost immediately made the acquaintance of Professor John Torrey, of New York. In the following year he was appointed a surveyor on the Mexican Boundary Survey, and in September, 1851, sailed from New York to New Orleans, and then proceeded overland, in company with C. C. Parry, to El Paso; from San Antonio, J. M. Bigelow was also a member of the party. Schott spent the entire year 1852 on or near the lower Rio Grande, with headquarters most of the time at Eagle Pass; some of his surveys were in a region never since visited by a botanist. At first he collected plants on his own account, but later he was officially authorized to collect not only plants but also specimens in other branches of natural history. After a few months,

It is as follows: "It is also in the lower portion of this belt [Coastal plain of Texas] (where the Palm tribe is represented by the *Chamaerops Palmetto*) that the Palmetto attains a growth as gorgeous even as that on the lower Mississippi; it extends on the Rio Bravo [Rio Grande] up to about 80 miles from the Gulf."

"In addition to the Palmetto common to the lower portions of these two great rivers, the constant appearance of a *Tillandsia* (Spanish moss) depending from the branches of the trees in long clusters increases the similarity of their scenery. Whilst the existence of this moss pronounces a higher degree of atmospheric moisture here than in the country above, the occurrence of the Palmetto may indicate the vicinity of the sea."[2]

The reference to a "gorgeous" growth of the cabbage-tree (*Sabal Palmetto*) on the lower Mississippi River seemed not as fantastic as Mark Catesby's reference to its occurrence in New England (see article on the cabbage-tree[3]), but it was, up to last year, unexplainable. However, we now know that Arthur Schott's record should have been taken as an interesting clue for investigation. The clue was not followed up; but after a lapse of three-quarters of a century, this palm was rediscovered by mere accident. On the tenth day of April, 1925, while driving from Point aux Herbes on Lake Pontchartrain to New Orleans, Edgar T. Wherry and the writer unexpectedly came upon a grove of palms which evidently represent the kind referred to by Arthur Schott in the above quotation. To meet with erect-stemmed palms far

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from February to April, in Washington and New York, he returned to the field in May, 1853, going overland to New Orleans and across country to the Rio Grande. Before the end of the year he was again in Washington, working on official reports for the survey. Late in 1854 he again took the field, at the western end of the Boundary, going by way of the Isthmus to San Francisco, and returning down the coast to San Diego, where he arrived about the first of November. Most of the year 1855 he spent along the lower Colorado River and in Sonora, and in 1856 and 1857 was at Washington, still connected with the Boundary Survey. Late in 1857 he spent several months with a surveying party in the Atrato River region of Colombia. The remainder of his life was spent in the employ of various governmental bureaus in Washington, where he died 26 July, 1875.—JOHN HENDLEY BARNHART.

[2] Report, United States and Mexican Boundary Survey, 1[2]: 44. 1857.

[3] Journal of The New York Botanical Garden 24: 145–158. 1923.

out of the known range of any such plant was a great surprise. A first glance at the trees naturally suggested the cabbage-tree (*Sabal Palmetto*). A second glance indicated something quite different. This palm, although resembling the cabbage-tree in habit, is really related to the blue-stem (*Sabal minor*). As this discovery was the direct outcome of the interest and coöperation of Mr. Charles Deering, this palm has been named *Sabal Deeringiana.*[4]

Shortly after Schott's note appeared, the country inhabited by the palm under consideration was referred to by C. C. Parry[5] in the following sentence: "*The flora of this strip of country* [Coastal Plain of Texas] *is too well known to require an account here, had we the necessary data for describing its characteristic botanical productions.*"[6] The italics are ours. Now, whatever this sentence may have been intended to mean is not clear, but it

[4] Torreya 26: 34–36. 1926.

[5] Charles Christopher Parry was born 28 August, 1823, at Admington, Gloucestershire, England. He came to America with his parents before he was ten years old, and his boyhood was spent on a farm in Washington County, New York. He was educated at Union College, and at Columbia, where he made the acquaintance of Professor John Torrey, who encouraged the interest he had already felt in botany. Receiving his medical degree in 1846, he went at once to Davenport, Iowa, which was his home throughout nearly fifty years of wandering, as a plant collector and intelligent field-observer. He was botanist of Owen's geological survey of the North-west, in 1848, and of the Mexican Boundary Survey, in 1849–51, and was at various times connected with other exploring and surveying parties, but when not so affiliated, he spent nearly every season in private botanical collection. Besides his work on the flora of Iowa and neighboring states, he acquired a critical field-knowledge of the plants of the entire Rocky Mountain region, the Pacific coast, the south-western states, and northern Mexico. He was always on the lookout for new plants worthy of cultivation, and many were introduced by him; he was the discoverer of the blue spruce, the nut pine, the Parry lily, and a host of other plants now well known. Many species of plants were named for him, and serve as perpetual reminders of his career both to the botanist and the horticulturist. Late in the year 1889 he returned from a visit to various parts of the northern Atlantic coast to his home at Davenport, where he died 20 February, 1890. His herbarium, of many thousand specimens, was purchased by the Iowa Agricultural College at Ames. —J. H. B.

[6] Report United States and Mexican Boundary Survey 2: 9. 1859.

FIGURE 3. In a virgin part of a palm grove, where the broad-leaved plants and palms meet and mingle. In some places the palms dominate, in other places the broad-leaved plants. If all the fruit of the palm would germinate and survive, other vegetation would be driven out, but animals evidently help to maintain the present balance. The cedar-elm (*Ulmus crassifoia*), Texas-ebony (*Siderocarpos flexicaulis*), mimosa (*Leucaena pulverulenta*), ash (*Fraxinus Berlandieri*), and acacia (*Acacia Berlandieri*) often grow with the palm.

may have been the cause of retarding botanical exploration in that region, which was then really almost a virgin botanical field and it has remained almost in the same condition up to the present time. The flora of the region in question certainly was not then " well known," as the above-cited quotation starts out to say.

The real reason for the lack of knowledge concerning the Texas cabbage-tree was that it grows in a part of Texas that was for a long time difficult of access and sparsely populated. When the species was first brought to light it was confused with the eastern cabbage-tree (*Sabal Palmetto*) and later associated with a different kind of palm native in southern Mexico, named *Sabal mexicana.* It was not until in 1901 the plant was given the specific name of *texana*[7] by O. F. Cook,[8] and shown to be different from the palms with which it had been confused and associated by name.

Less, apparently, has been written about the Texan cabbage-tree than about any other of our palms.

Following are the principal notes that have appeared in print relating to it after the one cited on a preceding page. In a paper by Valéry Havard[9] entitled "Economic Notes on the Texana-Mexican Flora," it is said that the palm in question grows:

[7] *Inodes texana* O. F. Cook, Bull. Torrey Club **28**: 534. 1901. *Sabal texana* Becc., Webbia **2**: 78. 1907.

[8] Orator Fuller Cook was born at Clyde, New York, 28 May, 1867. He graduated at Syracuse University in 1890, and was an instructor there the following year. For the next seven years, as special agent for the New York State Colonization Society, he made many visits to Liberia; since 1898, at first as agent and later as botanist for tropical agriculture and bionomist of the United States Department of Agriculture, he has repeatedly visited various parts of tropical America. Ever since 1898, also, he has been an assistant curator and custodian in the United States National Museum. His scientific interests are of unusual breadth, embracing myriapods and general biologic problems as well as studies on economic plants of tropical regions.—J. H. B.

[9] Valéry Havard was born 18 February, 1846, near Compiègne, France. Coming to America as a young man, he was graduated at Manhattan College, New York City, in 1869, and received his professional degree from the New York University Medical College the same year. In 1874 he entered the medical corps of the United States Army, in which he was in active service continuously, rising by successive stages to the grade of Assistant Surgeon General and rank of colonel, until retired automatically upon reaching the age limit, 18 February,

"In sparse clumps from the mouth of the Rio Grande up the river to Edinborough, from 20 to 30 feet high, apparently identical with the Palmetto of South Carolina."[10]

In a paper relating to Texan plants, by Sereno Watson,[11] this cabbage-tree is referred to as follows: "A palm which in the

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1910. It was chiefly in his earlier experience at various frontier posts, in the West, that he devoted much time to the study of economic botany, as well as of the food-plants and drink-plants of Indians, Mexicans, and early settlers. He showed a decided inclination to the useful and attractive qualities of plants, and it is as a student of such, perhaps, that he is best known to botanists, although he has published a number of articles dealing with the flora of Montana, North Dakota, Texas, Colorado, and Cuba. We may especially refer to the "Reports of the chief of engineers, U. S. A." for the years 1878 and 1880, and more particularly to the "Report on the Flora of Western and Southern Texas," published by the U. S. National Museum in 1885. While in Cuba, in 1901, he also published in The Plant World "Notes on Trees of Cuba," of much interest to northern tree-lovers. In 1898, in our war with Spain, he went to Cuba with a cavalry division, rising to the rank of chief surgeon of all U. S. troops on the island, and playing a very important part in expelling yellow fever from it. In 1902, he was sent as delegate to an International Conference in Brussels, Belgium, and to special manoeuvers of the Medical Department near Paris, France. In 1904, he was detailed as medical attaché with the Russian Army in Manchuria. While near Mukden he was captured by the Japanese and obliged to return by way of Yokohama, an unexpected event which greatly extended the field of his experience. In 1906, he was transferred to the Surgeon General's office, in Washington, where he remained on duty until retirement in 1910. Several years later, in our war with Germany, still enjoying good health, he offered his services to the government and was sent to Cuba to reorganize the medical department of the army and navy, remaining over four years in that capacity, and receiving the Cuban "Order of Military Merit." In recent years he has been living in retirement at Fairfield, Connecticut.—J. H. B.

[10] Proceedings, United States National Museum **8**: 524. 1885.

[11] Sereno Watson was born 1 December, 1826, at East Windsor Hill, Connecticut. He was graduated from Yale in 1847, spent nine years (1847–56) teaching school and studying medicine (he took no medical degree), and five years (1856–61) in the insurance business at Greensboro, Alabama. At the beginning of the Civil War he returned to Connecticut, and became an assistant in literary work to Dr. Henry Barnard, of Hartford. In 1867 he went to California, and in July of that year entered the camp, on the Truckee River, Nevada, of Clarence

FIGURE 4. Among the resacas of the Rio Grande near Brownsville, Texas. The groves on these level plains are destitute of broad-leaved shrubs and trees, whether naturally so we do not know. These areas are now used for growing Indian-corn and other crops. They have the appearance of Indian fields and many have been cleared of brush originally by the aborigines. It will be noticed that, as in the case of the cabbage-tree (*Sabal Palmetto*), the palmetto-palm either sheds or retains its "boots" (leaf-bases).

present imperfect knowledge of the species cannot be distinguished from *Sabal mexicana* was collected by Berlandier (n. 877, "Corypha edulis") near Matamoros, and has more recently been found on the Texan side of the Rio Grande near Brownsville by Dr. Gorgas[12] and by Prof. C. S. Sargent. . . . It is said to be frequently 20 or 25 feet high, with a well-defined trunk 10 or 12 inches in diameter. The petioles are very stout (1½ inches broad at the summit), with a ligule 6 inches long, and the blade (3 feet long or more) cleft a third of the way down between the plaits, which are an inch broad. The spadix is elongated and slender; the calyx and petals (1½ lines long) strongly nerved. The berries are often in pairs, 9 lines in diameter, sweet and edible; seeds 5 or 6 lines broad by 3½ thick, very much larger than those of any of the Atlantic States' species."[13]

A few years later, C. S. Sargent[14] published the following note:

King, then in charge of the geological survey of the Fortieth Parallel. He remained as a voluntary assistant to the botanist of the survey, who was in poor health, and in March of the following year, by official appointment, succeeded him. Thus, at the age of forty, he first devoted his energies to the science with which his name will always be associated. He had long taken some interest in plant study, but his volume on the botany of this survey at once established his reputation as a scholarly and critical botanist. He became curator of the herbarium at Harvard in 1870, and so continued for nearly twenty-two years. His health was permanently impaired by an illness contracted while on a collecting trip in Guatemala, in 1885, but he continued his active work of study and publication until his death; this occurred at Cambridge, Massachusetts, 9 March, 1892.—J. H. B.

[12] William Crawford Gorgas was born 3 October, 1854, at Mobile, Alabama, and died in London, England, 4 July, 1920. A graduate of the University of the South, in 1875, and of Bellevue Medical College, in 1879, he entered the medical corps of the United States Army in 1880, being surgeon general from 1914 to his death in 1920. His early service, like that of most young army surgeons, was at western posts. His later work in the attack upon yellow fever, resulting in the elimination of that disease from Cuba and the Panama Canal Zone, brought him many honors, and spread his fame throughout the world.—J. H. B.

[13] Proceedings American Academy **25**: 135. 1890.

[14] Charles Sprague Sargent was born 24 April, 1841, at Boston, Massachusetts. After graduation from Harvard University in 1862, he entered the army, leaving the service at the end of the Civil War as brevet major of volunteers. He was director of the Arnold Arboretum, at Jamaica Plain, Massachusetts, from its establishment in

"In Texas, where it was first detected about seventy years ago by the Belgian botanist Berlandier,[15] *Sabal mexicana* grows in the rich soil of the bottom-lands of the Rio Grande from the neighborhood of Edinburg nearly to the Gulf, with *Ulmus crassifolia, Acacia Berlandieri, Fraxinus Berlandieriana, Leucaena pulverulenta,* and *Erythrina herbacea.*"[16]

The distribution of *Sabal texana* is confined to a comparatively small area in the lower Rio Grande Valley. It grows along the banks of the river, but not on the Gulf of Mexico. Occasionally one or two trees are found on the banks of the resacas. On the Texas side of the Rio Grande, beginning at El Salado ranch, ten miles below Brownsville, the first palms appear in the bend of the river. Thence they extend up the river three or four miles, in great abundance. On the Burns' ranch at San Rafael, which adjoins El Salado, the palms form large clumps along the river bank and along the bank of a resaca, which lies within the same ranch. On the Singer ranch, which adjoins the Burns' ranch, a very beautiful grove is located between the river and a resaca, and further up, on the Frank Rabb ranch, the most beautiful grove of all is located. There the palm trees and a tall cane form dense thickets or jungles. The palms grow to a height of about fifty feet and reach their perfection in the last-mentioned grove.

1872 to his death, 22 March, 1927, and thus devoted about fifty-five years to the study of woody plants. His work in the development of the Arboretum, and his numerous elaborate publications, have made his name familiar to all botanists and tree-lovers.—J. H. B.

[15] Jean Louis Berlandier was born at Ghent, Belgium, about the beginning of the nineteenth century. From 1823 to 1826 he was at Geneva, Switzerland, studying under de Candolle the genus Ribes. His monograph of this genus was published in 1826, and his treatment of the same group for de Candolle's Prodromus in 1828. Meanwhile he had gone to Mexico, and settled as an apothecary at Matamoros, near the mouth of the Rio Grande, which was his home for the rest of his life. His plant-collections were numerous, and are represented in various herbaria; the earlier ones were made in Tamaulipas, Nuevo León, Coahuila, and San Luis Potosí; later he made much larger collections in western Texas. He was drowned while crossing a small stream near Matamoros, in 1851. His manuscripts and drawing are preserved at the Gray Herbarium of Harvard University. The composite genus *Berlandiera* was dedicated to him by de Candolle, and many species of plants have been named in his honor.—J. H. B.

[16] Silva **10**: 43. 1896.

FIGURE 5. On a ranch near Brownsville, Texas. A jacal, as the Mexicans call their habitations. The sides of these houses are built of lengths of mesquite wood (*Prosopis glandulosa*). The panels are sometimes plastered with the clay of which the delta of the Rio Grande is composed. The roof is made of a thatch of palm leaves. A palm tree (*Sabal texana*) brought from the nearby palm grove, and mimosa trees (*Leucaena pulverulenta*) with feathery leaves shown in the figure, are usually planted about the houses.

Heller's hackberry (*Celtis Helleri*), from which the long-moss (*Dendropogon usneoides*) hangs in great abundance, mimosa (*Leucaena pulverulenta*), ash (*Fraxinus Berlandieri*), and a tall cane (called *carrizo* by the Mexicans) are the principal plants that accompany the palmetto-palm on the Rabb ranch, but in addition to the plants just mentioned, there occur prickly-pear (*Opuntia Lindheimeri*), dildoe (*Acanthocereus pentagonus*), ball-moss (*Tillandsia recurvata*), Texan-ebony (*Siderocarpos flexicaulis*), and a number of twining vines. The grove contains about 100 acres of palms. This paragraph and the succeeding ones are based upon information furnished by Robert Runyon,[17] of Brownsville, Texas, and observation by the writer in the spring of 1925.

Above the Rabb ranch only a very few scattering palms are found on the Texas side of the Rio Grande, and there are none above Santa Maria, which is about 60 miles from the Gulf of Mexico.

On the Mexico side of the Rio Grande the distribution is confined to a narrow strip along the river. A very pretty grove is located on the Santa Rosa ranch six or seven miles below Matamoros, and a few scattered palms grow along the banks of the river as far up as the Huasteca ranch. There a large grove extends about a mile along the river. With the exception of some trees in Matamoros, the above lines indicate about all the palm growth on the Mexican side of the Rio Grande.

Other associated plants in addition to those mentioned above, and the plants that are common nearly everywhere, are the cedar-elm (*Ulmus crassifolia*) and the river-cypress (*Taxodium mucronatum*).

The common name of *Sabal texana,* in and around Brownsville, Texas, is palmetto-palm, while the Mexicans term it " La Palma

[17] Robert Runyon was born 28 July, 1881, at Catlettsburg, Boyd County, Kentucky. In March, 1909, he left Kentucky for Brownsville, Texas, which has since remained his home. He is a photographer by profession, and is one of the proprietors of a curio shop in Matamoros, Tamaulipas, across the river from Brownsville. He was interested in botany before leaving Kentucky, and has familiarized himself with the flora of the lower Rio Grande valley, on both the Texan and the Mexican sides of the river. The genus *Runyonia* was named in his honor by Rose, and several of the many species discovered by him bear his name.—J. H. B.

de Micharo." The palmetto-palm is extensively cultivated as an ornamental, and trees may commonly be seen in the yards and the plazas of towns of the lower Rio Grande Valley, from Point Isabel to Santa Maria.

The leaves are used as a thatch to cover houses, by the poorer class of Mexicans. The little houses are called "jacals." The trunks are used for posts, which are durable in contact with the soil and last a lifetime. The fruits are edible, and they are sold in the markets of Brownsville and Matamoros under the name of "Micharo."

The palmetto-palm grows from thirty to fifty feet tall, and is very erect, with a round naked trunk when the tree is matured; but while young the leaf-stalks (boots) cling to the trunks and form a lattice work. The crown of leaves is round and always light-green in color. The leaves do not freeze in cold weather as easily as do those of other cultivated palms. Its growth is slow, and a period of twenty-five to thirty-five years is required for a tree to mature, but when once established it is very hardy. It is difficult to transplant, but grows readily from seed.

Sabal texana forms dense jungles in some localities with a tall cane and the hackberry, mimosa, and ash mentioned above, and a mixture of other small trees and shrubs. In other localities it grows in fields now cultivated in the river bottoms.

The trees and shrubs that accompany *Sabal texana* are numerous, in fact nearly every tree that grows in the lower Rio Grande Valley, occasionally grows with or near the palms. The ones mentioned above are the most common in the palm groves.

JOHN K. SMALL.

TULIPS[1]

The constant recurrence of the tulip in flower, in poetry, in garden lecture is justified, if only to keep before the public the name of a flower preëminently useful for home, window box, city garden, suburban grounds, and country estate.

The tulip (from the Persian *toliban,* meaning turban) is a wildflower of countries bordering the Mediterranean, such as Pales-

[1] Abstract of illustrated lectures given at The New York Botanical Garden on May 15, 1926, and May 7, 1927.

tine, and many kinds are found in Turkestan and in Bokhara, in the Asiatic desert.

Persons interested in tulip species may see many in the Rock Garden in The New York Botanical Garden. The tulip of cultivation came from Turkish gardens in and around Constantinople. Most tulips grown during the "tulipomania," the Holland craze of 1653, were of the striped and feathered flowers known as bizarres, bybloems, etc. The wild tulips have usually pointed, narrow petals; and the Dutch, by constant selection, secured broad rounded petals. These cup-shaped flowers, with gay, striped colors, were grown up until 1850, over a period of time known as a quiet one in tulip circles as compared to the craze of the 1600's. In the middle of the last century the tulip staged a "comeback." In 1854 a perusal of a list of some 150 varieties of spring tulips gives us only bizarres, bybloems, and "roses," all old classes and with names now unrecognized; by 1874, one finds listed some of the early single varieties with same names as those that now bloom in our gardens. These early single varieties have short stocky flowers with colors yellow, white, pink, pink and white, purple, and red. There are also double forms of the early tulip. Then, the "cottage" tulips, slender vase-shaped flowers with pointed petals and clear but delicate shades of yellow, pink, and red, came upon the scene. It is said that these tulips received their name on account of being collected from various old cottage gardens of England. It is possible to conceive of seedlings, from old round-petaled tulips, going back to their ancestral character of narrow, pointed petals. The cottage tulip is taller and more graceful than the early, and its color more striking. In many varieties the fragrance, too, is distinct.

The Darwin tulip race came from French seedlings, and represents a distinct type. It has varieties with tall stems, up to 30 inches, with cup-shaped flowers whose petals are thick, almost fleshy, and consequently very durable and lasting when cut. This type has been the most desired of late in gardens. Another group of tulips, the "Breeder" type, contains varieties also tall and thick petaled, especially noted and admired for color effects, of old gold and bronze, of plum, purple, and certain mahogany-brown shades.

Recommending varieties of the modern tulip for any one particular use or situation is quite unnecessary. They appear in-

dividually; it is a matter of the grower's or viewer's taste. For instance, one might cite the so-called "Black Tulip." One reads in the novel of that name by Dumas, which is about the tulip-fanciers of Holland in the time of William of Orange, of the quest for the black tulip, of the guarding and care of the three bulbs eventually produced by Van Baerle, the hero, of the jealousy of his neighbor Boxtel and said neighbor's consequent attempt to obtain the three precious bulbs; and of the later flowering of the "black tulip" under the loving care of the heroine of the tale, and the prize of 100,000 florins for it. Today the black tulip is represented in our collections by a group of "La Tulipe Noire", an almost black Darwin, and by Faust, Zulu, and others of the same shade. Perhaps one would today award the prize to a tulip variety of another color.

An idea often expressed about tulips by persons not well acquainted with them concerns a short season of bloom. This idea is usually changed after visits to The New York Botanical Garden, where nearly 250,000 tulips have bloomed in the last eight years. Yearly visitors have learned that the whole of a planting of 60,000 will not bloom at the same time. This season (1927) proves no exception, as the first bloomed in late winter over a warm cellar, and before the late Darwin tulips are through, the month of May will be gone. The division of our big collections into early and late seasons being of about equal proportions, one half, of early kinds, is planted in the Court of Conservatory Range No. 1, the other, of late sorts, is planted below the Rock Garden, at the Fordham Hospital entrance. These tulips, 114 varieties, show what the possibilities are in stretching the season of bloom, so much so that they must be viewed at least three times during the season to get all the beauties of the display. They include material for a long spring season of great delight for large or small garden. The early single tulips give the widest range of color variation. The striking quality of these early varieties, excluding the whites and some of the pink and whites, is their brightness. This is true especially of the reds, one of the earliest of which is Vermilion Brilliant. Prince of Austria, orange-red, comes a few days later. The most brilliant of the reds, one of good substance and lasting qualities, is Couleur Cardinal, cardinal-red with oval blooms and pointed petals. The outside first color of such a variety is almost a plum red, but, as with all the other colors, the de-

velopment is gradual and the true tone does not show until the flower is quite old. Three yellow varieties are in the garden display, Yellow Prince an early round, Mon Trésor, a mid-season sort with lasting qualities, and Rising Sun, an open cup of golden tone. Leading away from red on the other side toward the purples is a fine carmine-purple, Proserpine. This tulip is a long, strong bloomer, which is fragrant, and endures for several years. Two with blue tones are Wouverman, a large claret-purple, and Van der Neer, a large tulip, violet-purple, practically blue at maturity. The well-known series of pink and white tulips, ranging

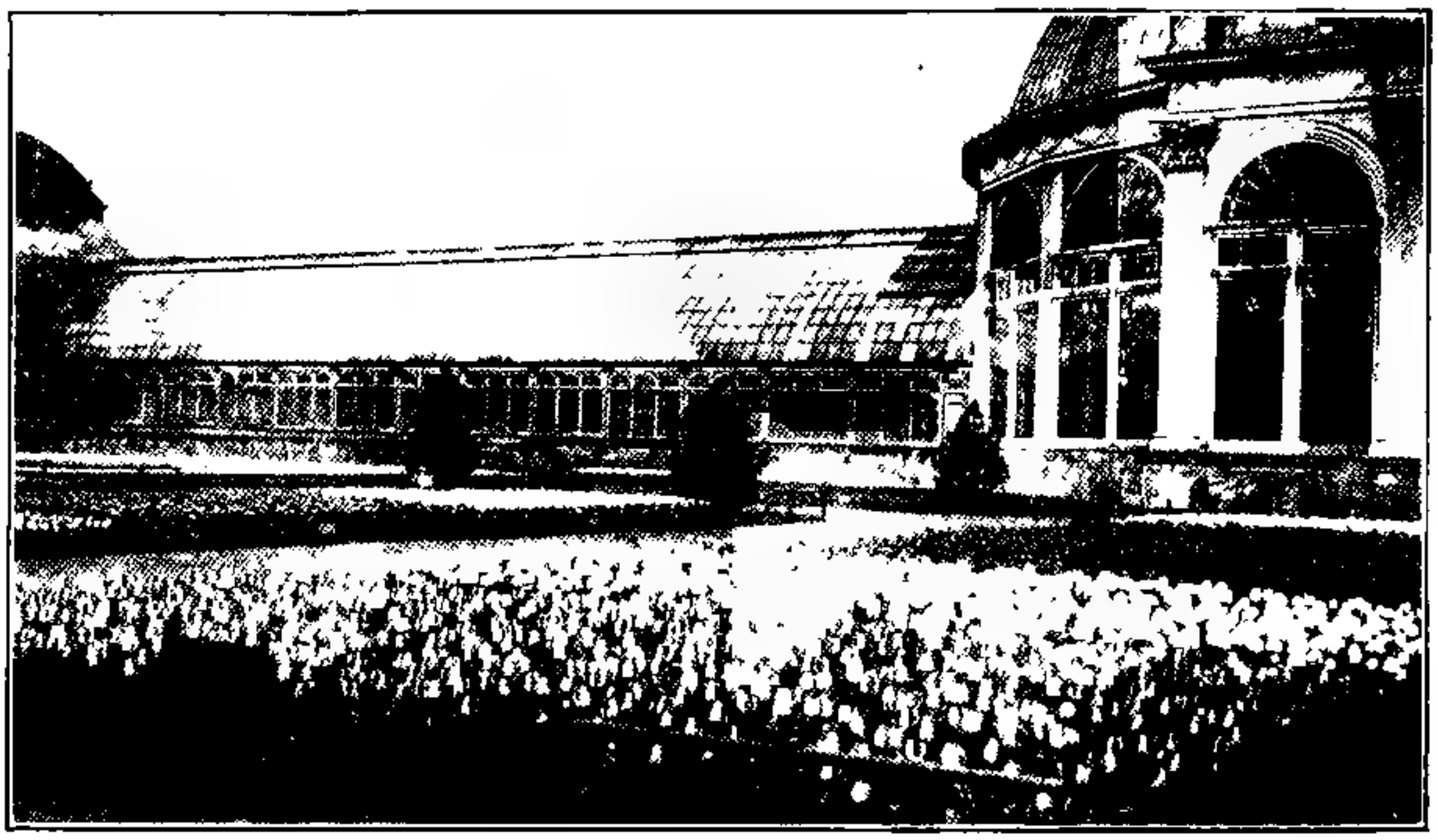

FIGURE 6. Some of the early tulips in the court of Conservatory Range No. 1, April 29, 1927. Photograph by Mrs. Wheeler H. Peckham.

from Pink Beauty with rich cherry color down to Rose Hawk which barely escapes being white, are all excellent bedding sorts, and while not so showy, are used more in garden combinations where light touches are needed. The early double tulips present a very uniform material for bedding, the height and size of bloom being very constant. The yellow Mr. Van der Hoeff, the yellow and red Titian, and the variety Tea Rose, made up of pink, white, and yellow shadings like certain tea roses, are well liked.

The later tulips, which are now perhaps the most popular, are represented by seventy-seven varieties.

The arrangement of groups of Darwin and other tulips against backgrounds of evergreens and early flowering shrubs provides a

magnificent setting for them. The planting of various perennials which flower at tulip time under and among the blooms is a coming feature with spring gardens. Mrs. Charlotte Cowdrey Brown, in "Gardens to Color," gives the following combinations: *Alyssum saxatile compactum* with bronzy tulips; *Bellis perennis* with pink and white tulips; *Mertensia virginica* with pale yellow tulips, as Moonlight, etc.; *Phlox divaricata* with Fawn and other tulips; Forget-me-not with tulips Tea Rose, Safrano or other doubles, or Baronne de la Tonnaye, rose pink; primroses (yellow) with Rev. Ewbank, Zulu, La Tristesse, La Tulipe Noire, and other Darwins.

With the planting of tulips in beds and borders with Iris and other flowers becoming usual, combinations from the garden of Mrs. E. A. S. Peckham, as outlined in Bulletin 20 of the American Iris Society, are adaptable to this purpose.

Some of these combinations follow:

Tulip Bouton d'Or
Iris Halfdan
Scilla campanulata Excelsior
Tulip Moonlight
Tulip Bronze Queen
Iris Ingeborg
Scilla campanulata Excelsior
Tulip The Fawn
Iris Ingeborg
Iris Fritjof
Phlox divaricata canadensis
Tulip Inglescombe Yellow
Iris Dolphin
Alyssum saxatile
Tulip Bouton d'Or
Camassia Leichtlini
Tulipa Clusiana
Phlox divaricata
Scilla campanulata alba
Tulipa Gesneriana ixioides
Tulip Miss Wilmott
Wisteria
Pansies (purple)

Tulip Paladin
Tulip The Fawn
Iris The Bride or Ingeborg
Phlox divaricata canadensis
Tulip Jubilee
Tulip Sophrosyne
Iris Fritjof
Scilla campanulata Rose Queen
Tulip Flamingo
Tulip Copernicus
Iris Marechal Victor
Tulip Bleu Aimable
Tulip Honeymoon
Iris Fritjof
Iris Queen Flavia
Scilla campanulata alba
Tulip Sophrosyne
Iris germanica
Scilla campanulata alba
Tulip Cardinal Manning
Tulip Sir Harry
White Wisteria
Iberis

Tulip Galatea
Muscari Argaei
Phlox subulata lilacina

Tulip Sir Harry
Iris Charmant
Scilla campanulata Rose Queen

Tulipa fulgens lutea pallida
Alyssum saxatile
Scilla campanulata Excelsior

Tulip Bronze Queen
Tulip Moonlight
Iris Fritjof
Phlox divaricata

Tulip Inglescombe Yellow
Tulip Dainty Maid
Phlox divaricata canadensis
Scilla campanulata Excelsior

Tulip Rev. Ewbank
Iris florentina
Iris germanica

Tulip Sir Harry
Iris florentina
Scilla campanulata Rose Queen

Tulip Gretchen (Margaret)
Iris Charmant
Primula veris

Tulip Sir Harry
White Violets
Bechtel's Flowering Crab

Tulip Avis Kennicott
Tulip Moonlight
Wisteria chinensis
Phlox divaricata canadensis
(Laphamii var.)

Tulip Prince Albert
Tulip Flava
Iris florentina
Myosotis

Tulip Galatea
Primula Sieboldi
Phlox divaricata canadensis

KENNETH R. BOYNTON.

THE FANNY BRIDGHAM FUND

In 1920, the Garden received an unconditional bequest of $30,000 from Mrs. Samuel Bridgham, which, at the meeting of the Board of Managers on January 10, 1921, was designated "The Fanny Bridgham Fund"[1] by the adoption of the following resolution:

"*Resolved,* That the legacy of $30,000 received from the estate of Mrs. Fanny Bridgham be designated a permanent fund under the name 'Fanny Bridgham Fund,' and that its income be used, after investment, for the purchase and binding of books for the library, unless otherwise ordered by the Board of Managers."

The income of this endowment, about $1,400 annually, has been of noteworthy help in building up the library, during the six years

[1] Journal, N. Y. Bot. Gard. **22**: 45, 46. 1921.

of its expenditure for this purpose, this collection of botanical and horticultural literature having now become, through the use of this fund and others, one of the largest anywhere brought together, including over 35,000 bound volumes and many thousand pamphlets.

Mrs. Bridgham was a sister of the late Mrs. John Innes Kane, who has also contributed liberally to endowment funds of the Garden and otherwise aided its work; they were daughters of the late Mr. William C. Schermerhorn, who gave $10,000 to the original fund of $250,000 required by the Act of Incorporation, to enable the Commissioner of Public Parks to appropriate land for the use of the Garden in 1895. Mr. Samuel Bridgham, before his marriage to Miss Fanny Schermerhorn, was by taste and profession a botanical artist; he made several hundred of the drawings used for figures in the "Illustrated Flora of the Northern States and Canada."

N. L. Britton.

NOTES, NEWS, AND COMMENT

Dr. John K. Small spent parts of April and May in the Gulf States, from Florida to Louisiana, collecting rootstocks of native irises. Plants were collected from scores of colonies, particularly in southern Louisiana and peninsular Florida. More than half a ton of rootstocks were shipped from the field. In addition to the material installed at the Garden, a plantation representing all the species and forms gathered was installed at Fourway Lodge, Coconut Grove, Florida. While in Louisiana he had the coöperation of Mr. and Mrs. Arthur Svihla, whose observations on the native irises during a residence in that state have added very materially to our knowledge of this little-known group of plants.

Meteorology for April. The total precipitation for the month was 2.84 inches. The maximum temperatures recorded at the Garden for each week were 67° on the 7th, 72° on the 16th, *93.5° on the 20th,* and 65° on the 27th. The minimum temperatures were 30° on the 4th, *28° on the 11th,* 31° on the 14th, and 31° on the 24th.

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GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 35,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

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BRONX PARK, NEW YORK CITY

VOL. XXVIII JULY, 1927 No. 331

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OF
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ETHEL ANSON S. PECKHAM

TWO ATTRACTIVE SMALL GARDENS
KENNETH R. BOYNTON

MYCOLOGY OF PORTO RICO AND THE VIRGIN ISLANDS
FRED J. SEAVER

FOSSIL PLANTS OF NEW YORK CITY AND VICINITY
ARTHUR HOLLICK

THE PRESENT STATUS OF EVOLUTION
HENRY C. COWLES

THE ROCK GARDEN
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PUBLIC LECTURES DURING JULY AND AUGUST

NOTES, NEWS, AND COMMENT

ACCESSIONS

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IRISES FOR THE HOME GARDEN[1]

The "home garden" is necessarily not very large, for even on the great estate the home garden would be that portion of the grounds closely associated with the house. This being the case, we cannot consider a garden wholly devoted to iris or an iris collection. Such gardens are not beautiful and are a mistake, as the bloom is not continuous, neither is the effect good after the flowers are over. Too much foliage of one shape is monotonous.

In the home garden the irises should be chosen for a particular purpose; either because they are of a fine, clear color or for their free-blooming qualities and the selection of varieties should cover as long a blooming season as possible. It is better to use two or three varieties which blend well and bloom together and have good masses of flowers than a great number of different kinds. The effect in the latter case is sure to be spotty. Remember also, that the majority of the colors should be light as, with few exceptions, dark irises disappear in the distance.

The first thing to decide is the character of your garden, exposure, kind of soil, etc. After that you can select your irises. Should your house be upon rocky ground, by all means have a rock garden and there are charming irises suitable for this purpose. Native dwarf varieties such as *Iris cristata, I. lacustris, I. verna,* some of the dwarf bearded hybrid varieties, purple, white, and yellow, a species or two from other countries, such as *I. aphylla* or *I. graminea,* and some of the tiny bulbous sorts belonging to the *reticulata* group are all good rock-garden subjects. Should you have the usual garden, sunny, not too flat,

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, May 21, 1927.

perhaps, and bordered by nice shrubs with perennial beds at their feet, you will gravitate towards the bearded irises. There are hundreds of varieties of these and hundreds too many for your purpose! If you have no rockery, the dwarfs mentioned before may, most of them, be tucked into the edges of the borders, here and there between the drifts of small spring bulbs. After the dwarfs will come the intermediates, many of which bloom at the same time as the May-flowering tulips, giving lovely color combinations. What could be prettier than the blue of iris Fritjof combined with tulips Bronze Queen and Moonlight and perhaps some blue-mauve *Scilla campanulata?* Or, again, white iris Ingeborg, pink tulip Flamingo, and *Phlox divaricata canadensis?* Lilacs are generally in flower with these intermediate irises and make an excellent background for them.

Keep to masses of pale colors with an accent now and again of a handsome dark variety such as Ambassadeur (or if your pocket-book does not run to this, Jacquesiana) or Lent A. Williamson. It is perfectly possible to get really good kinds of bearded irises cheap. Most of them increase very rapidly, so, an investment in the best is well worth while. It generally only means a little patience and the good gardener knows he or she must be well supplied with this commodity. The bearded irises do best in well-drained, sunny positions and enjoy lime in the soil. When planting, the rhizomes should sit on the surface of the soil, like a boat at anchor, and the roots may act as the anchors, so you can pound in hard what roots are present into quite a small hole, for in most cases these roots will die off and new ones put out from the rhizome will quickly nourish your plant. When the clumps become crowded and rhizomes begin to climb one upon the other, it is time to divide. This is best done directly after the bloom is over, for in this way you get a long period of growth. However, the bearded irises may be transplanted almost any time during the growing season provided it is not too late in the autumn. If you plant very late they do not get started before winter. Do not use stable manure near irises. Many diseases are carried in this way. If you feel you must cover late-planted sorts to keep them from "heaving" use a very light mulch of salt-hay and for fertilizer bone-meal is the thing.

Besides the bearded irises we have those without a beard such as the Siberians, *orientalis,* Japanese or *I. Kaempferi* varieties and some of our natives, as *I. versicolor, I. prismatica, I. missouriensis, I. hexagona,* etc. These, many of them, do well in damp locations, especially *versicolor* and the wild European *I. Pseudacorus.* On the edges of streams, by lakes and small pools they are particularly delightful. You would not want many of these in a home garden but a few are necessary to carry on the season and nothing is more satisfactory for cutting for the house.

FIGURE 1. Irises in the garden of Mrs. L. W. Hitchcock, New Rochelle, New York. Queen of May on the left; Ambassadeur (in bud) on the right. Photograph by B. McNeil.

Japanese irises are "choosy" about location and, in my experience, do not enjoy a diet of lime, so it is advisable to keep them out of the perennial borders where the bearded irises are so satisfactory. The Japanese sorts like rich soil that is light and are also known to flourish in a well-drained gravelly soil, while a mulch of cinders seems to be of decided benefit. The ubiquitous peat-moss may be the thing to try for these. Unfortunately there is a disease that attacks these irises and we do not yet know how to combat it. Often when we think *I. Kaempferi* has been winter-killed it is really the result of the ravages of this disease. The roots are dried off and the plant can get no food, so it

gradually dies. The time to transplant the majority of the beardless irises is as early in the spring as you can dig. The exceptions to this rule are the crested irises which are often grouped with the beardless ones. Move these just after blooming.

Besides the groups I have mentioned there are some bulbous irises we neglect here a good deal and which could be used to advantage. The best of these are *I. xiphioides* varieties, the so-called English Iris. These are natives of Spain and North Africa and there are many good new garden hybrids. They seem to be quite hardy here and persist far better than their cousins, the Spanish and Dutch irises. These latter are gross feeders and soon exhaust the soil they are planted in, so it is well to replant every two years and they need a slight covering over winter. I have found too, that the *reticulata* group need to be lifted and divided and they object to roots of coarse plants such as Phlox, being near them. Thyme makes a good ground cover for bulbous irises. *I. reticulata* comes very early in the spring, often by the twenty-fourth of March, and the flowers stay open a number of days, besides having a most exquisite perfume. The blooms are attractive in water in the house also. The Quarantine 37 has made it hard for us to get these bulbous irises but dealers are importing more and more of them and growing them very well out on the West Coast, so that they are obtainable now, though not in the number of varieties as heretofore. In his book "Hardy Bulbs for Amateurs," Mr. Joseph Jacobs gives good lists of bulbous irises suitable for the garden.

You have probably heard a good deal about the iris borer, but it is not so very hard to deal with. Vigilance is the word. The best way is to chase him. Find him and dispatch him. By going about your garden in the early part of the growing season and looking for signs of dampness on the edges of the leaves or a little thick spot, you can turn the trick. If it is the spot, squeeze it hard! If the chewy, damp edge, cut the leaf or stalk off below it. After the bloom is over cut the flower stalk off at the ground and burn it. You will not have many of the grubs then. Good and frequent cultivation is a great help, for, if the larvae get into the ground your fork will probably harm them sufficiently. If your plants are attacked with iris "rust," use a spray such as potassium sulphide or pyrox early in the season and the removal

of all affected leaves is essential. Never put such débris upon the compost heap. The bonfire should be its destination. A well-cultivated and well-weeded garden is little liable to disease. As the home gardener desires the best of the standard varieties and an occasional novelty, it is well for him to consult the special plant societies and the lover of irises is well served in this respect, for the American Iris Society publishes excellent bulletins dealing with all departments of the iris world and the dues are small. Test gardens are located in different parts of the country where one can study the varieties and "black lists" are published to help the amateur to avoid undesirable sorts. Wonderful new varieties are being raised all the time and wonderfully bad old ones are being scrapped. Shows are being held and new seedlings must stand a rigid test to be certified. Enthusiasm for one's favorite flower is well illustrated by the Belgian mechanic member of the A. I. S. to whom the dues of three dollars mean a week's wages. This earnestness of purpose and love for certain plants is something as well worth cultivating as the plants themselves.

ETHEL ANSON S. PECKHAM.

TWO ATTRACTIVE SMALL GARDENS

The spring aspect of the 1926 Prize Garden contains a profusion of tulips, pansies, and English daisies. A week or two after the accompanying photograph (FIGURE 2) was taken the irises bloomed, together with fragrant lilacs behind the garden seat, and bleeding heart, bush honeysuckle, and other shrubs and perennials in the borders. The yellow alyssum, blue phlox, grass pink, and other low perennials make up the edges not covered by the pansies and daisies. Alpine rock cress, Aubrietia, snow in summer, and moss pink, following Crocus, are blooming in the rockeries near the pool, and daffodils among the unrolling fern fronds under the birches. Later the bush honeysuckle fruit is a treat to catbirds from nests in neighboring beds, followed by feasts of elderberries for these feathered friends. The yellow on goldmoss and moneywort, and the blue on forget-me-nots, decorate the banks of the pool, and the lily pads fill it. The late summer period is an exceedingly floriferous one in this garden, as the

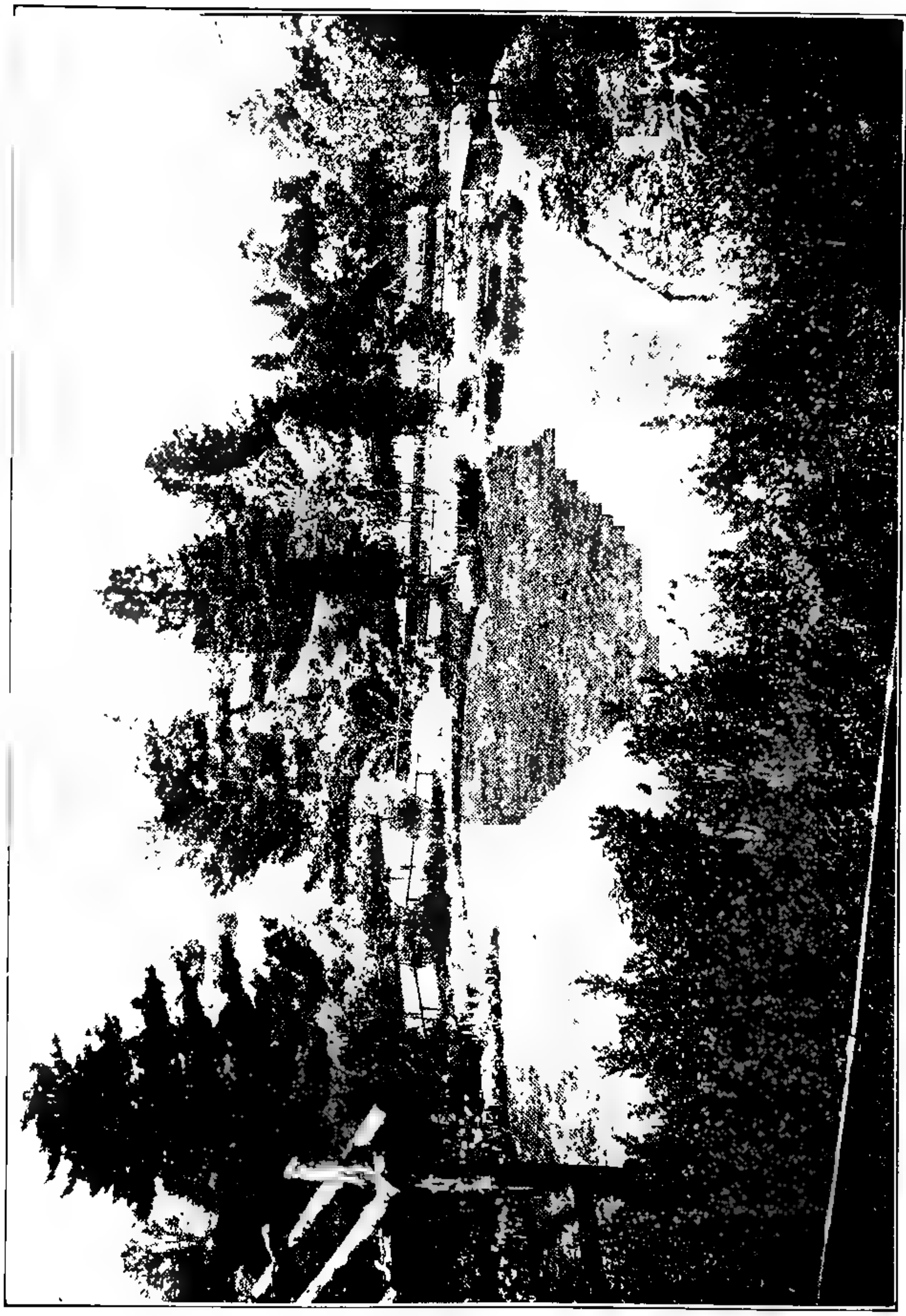

FIGURE 2. The 1926 Prize Garden, designed by Mr. Archie S. Hill, Wauwatosa, Wisconsin. Photograph by Miss Fleda Griffith, May 13, 1927.

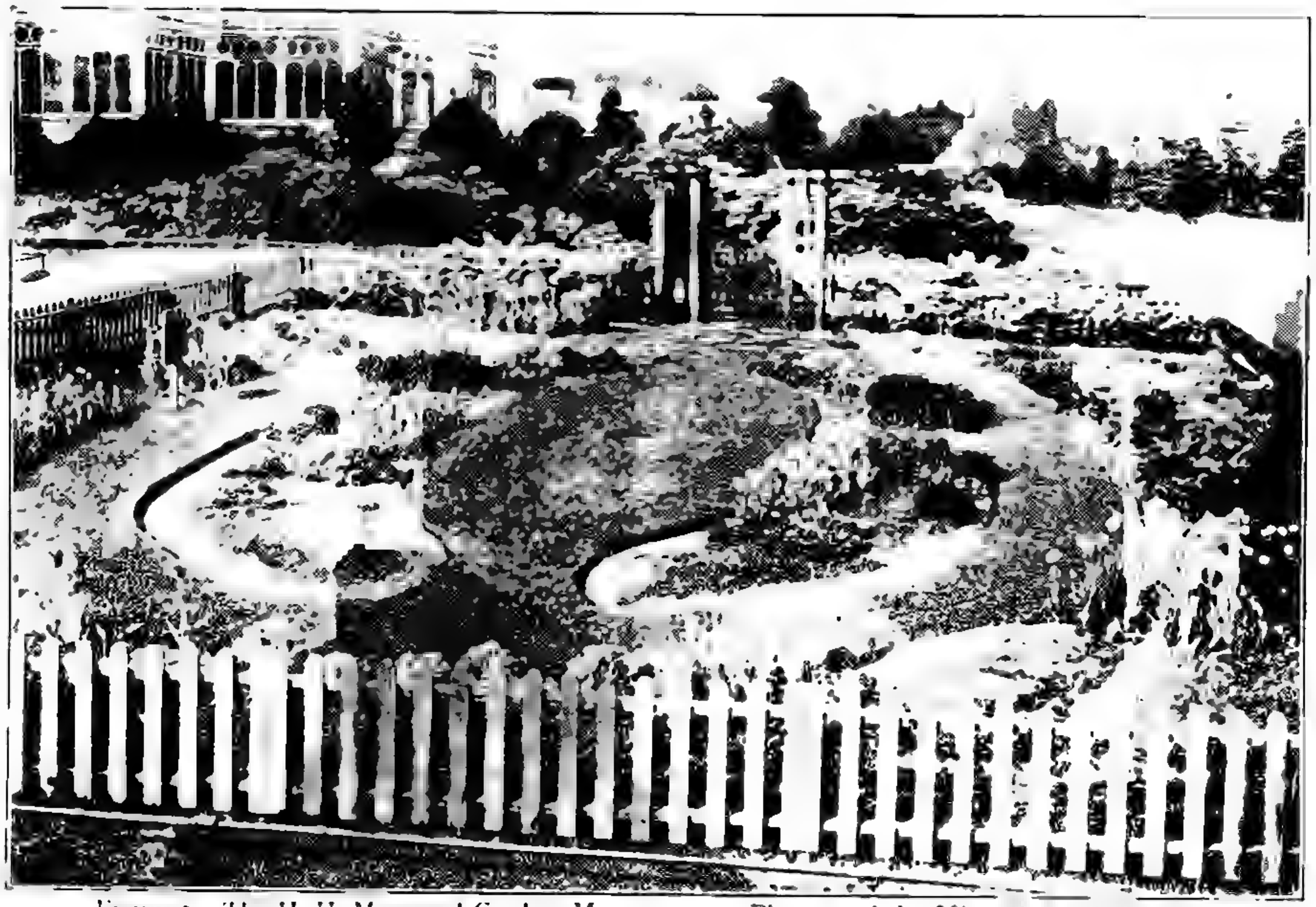

FIGURE 3 The H H Memorial Garden, May 14, 1927. Photograph by Miss [illegible]

Michaelmas daisies, *Veronica longifolia subsessilis,* and other perennials are exceptionally vigorous there.

The H. H. Memorial Garden is most delightful at the period in spring when the accompanying photograph (FIGURE 3) was made. Then the bright-colored azaleas, along the fence in the rear, and the tulips bloom. Later, when the climbing roses flower, another interesting season comes. The American Pillar over the entrance arbor, shown in the rear center, is especially active in producing flowers, and is attractive to visitors.

KENNETH R. BOYNTON.

MYCOLOGY OF PORTO RICO AND THE VIRGIN ISLANDS[1]

Probably the first extensive paper published, at least since American occupation, on the fungi of Porto Rico was the "Uredinales of Porto Rico Based on Collections by F. L. Stevens," published by Dr. J. C. Arthur in January, 1916. In April of the same year, Professor F. L. Stevens brought out his monograph of "The Genus *Meliola* in Porto Rico," in which he described many new species. In 1917, Dr. J. C. Arthur published a second paper on "Uredinales of Porto Rico Based on Collections by H. H. Whetzel and E. W. Olive." The following year, 1918, Mr. John A. Stevenson made the first attempt to prepare a complete synopsis of the fungi known in Porto Rico, incorporating all of the work of Arthur and Stevens. This was published under the title of "A Check List of Porto Rican Fungi and a Host Index." In the preparation of this work, Mr. Stevenson spent some time at The New York Botanical Garden and the writer assisted him in going through the collections and listing all of the fungi from Porto Rico contained therein.

Shortly after this, Dr. Britton asked the writer to treat the fungi of Porto Rico and the Virgin Islands for the Scientific Survey of that region which was being published by the New York Academy of Sciences. At this time Dr. Murrill was still at The New York Botanical Garden and it was assumed that he would contribute the work on the higher Basidiomycetes, as he

[1] Presented at the Conference of the Scientific Staff and Registered Students of The New York Botanical Garden, April 6, 1927.

doubtless would have done had he remained with us. Soon after this work was started, Mr. Carlos E. Chardon, a Porto Rican, who had just graduated from Cornell University, specializing in mycology, returned to Porto Rico and was employed by the Insular Experiment Station. Since Mr. Chardon was a native Porto Rican, a graduate from an American University, and a mycologist, it seemed quite fitting that he should coöperate in this work.

On April 11, 1922, he was asked to become a joint author in this undertaking, to which request he acceded. It was the understanding that Mr. Chardon would assist in the field work, while the writer and senior author would look after the literary end of the production. During the same year Mr. Chardon addressed a letter to The New York Botanical Garden, stating that the Porto Rican Government was ready to appropriate money to pay the expenses of the writer on a collecting trip to Porto Rico in company with Dr. and Mrs. N. L. Britton. This offer was finally accepted. In making this offer, Mr. Chardon stated that it did not seem quite right to ask a man to write the fungi of a region which he had never seen.

Arrangements were made and the period from January 24th to April 4, 1923, was spent in this work. It was the intention of the writer on going to Porto Rico to specialize on groups of fungi which had been overlooked by previous workers, especially the Pyrenomycetes and Discomycetes. The rusts had been so thoroughly collected by Stevens, Stevenson, Whetzel and Olive, and numerous local workers that it was thought hardly probable that any new material would be found in this particular field. However, the very fact that the plants of this group had been thoroughly collected was an incentive to try to get some additional information which had been overlooked by previous collectors. The host-index, prepared by Stevenson, was a decided aid. Also the fact that the writer worked for the most part in company with Dr. Britton, gave him an unusual opportunity to get the hosts determined immediately in the field. Once the host was determined, it was a simple matter to check up the host-index and find whether or not the rust had previously been collected.

The host-index was taken into the field on all occasions and after collecting for some time, we began to think that previous

workers had found all the rusts that there were to be had. It was not long, however, before a rust was found in great abundance on a plant identified by Dr. Britton as *Salmea scandens.* A glance at the host index showed nothing reported on this host and a specimen was immediately dispatched to Dr. Arthur, who eventually reported it as *Uromyces Salmeae,* a rust not only new to Porto Rico but previously known only from the type collection in Guatemala. This was the first addition made by us to the rust flora of Porto Rico.

The next rust to attract attention, was collected near the lighthouse on the island of St. Croix on *Anthacanthus spinosus,* a host which occurs also in Porto Rico. As no rust had been recorded for this host it was referred to Dr. Arthur and eventually described by Dr. Jackson as a new species, *Uromyces Anthacanthi.* This was the only new species of rust collected by us during our stay in the islands. However, the recent report on the rusts of Porto Rico and the Virgin Islands shows the following results of our collecting trip so far as the rusts are concerned: one new species; six species not previously known from Porto Rico and some of them very rare; also two species which had been collected only once previously to this in Porto Rico.

In 1924, Professor H. H. Whetzel of Cornell University and Professor F. D. Kern of Pennsylvania State College were also invited by the Porto Rican Government to spend a few weeks collecting rusts in that island. Following this they were asked to contribute the rust part of the fungi for our Porto Rican Survey, which they did. As a result of the work of the numerous uredinologists who have collected in those islands and the careful work of Whetzel and Kern in assembling the results, our knowledge of this group is more nearly complete than that of any other group of fungi.

Since Dr. Murrill had in the meantime severed his connection with The New York Botanical Garden, Dr. L. O. Overholts of the Pennsylvania State College was persuaded to contribute the part relating to the higher Basidiomycetes. Thus the completion of the Mycological Survey of Porto Rico and the Virgin Islands was made possible not by one person but through the coöperation of a large number of American mycologists, although we have as-

sumed the responsibility of putting the work through the press and writing much of the manuscript.

Something should be said regarding the host-index of this work. After the manuscript was prepared, it was found that the host names in many cases did not conform to the nomenclature employed by Dr. Britton in previous numbers of the Scientific Survey. To Mr. Percy Wilson of The New York Botanical Garden belongs a good deal of the credit of revising this host-index in order to make it consistent with the rest of the work. To him also belongs the credit of having read several times the proof of the host-index and weeding out many errors which perhaps might not have been detected by a mere mycologist.

Dr. H. M. Fitzpatrick of Cornell University has very kindly prepared a review of the mycology of Porto Rico and the Virgin Islands and from his report we find that the work contains a description of thirty-three new species, three new genera, and a number of new combinations. In addition to the workers previously mentioned, new species have been described by Rafael A. Toro, C. R. Orton, C. L. Shear, and the late C. G. Lloyd.

The entire work as it is published consists of 208 pages and while it comprises all of our present knowledge of the fungi of the region covered, it is not offered as a finished work, for we feel that many groups of the fungi have scarcely been touched upon. It is therefore offered merely as one more step toward a complete knowledge of the fungi of that section of the West Indies.

FRED J. SEAVER.

FOSSIL PLANTS OF NEW YORK CITY AND VICINITY[1]

The title or the subject of the lecture may have been the cause of surprise to some who read it, for except to those who are specially interested, it is not generally known that fossil plants are to be found in this immediate vicinity. If, however, the collections in the basement hall of the Museum are examined, a number of specimens may be seen that were collected not only

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, November 13, 1926.

in the vicinity of the City but within the municipal boundaries on Staten Island and Long Island.

In order to understand the geologic age of these fossil plant remains, and the conditions under which they occur, it is necessary to know something about certain of the geologic features that obtain in this region.

If a geological map of New Jersey is examined a broad band may be noted, extending in a southwest-northeast direction, from the Delaware River to Raritan Bay. This band represents the outcrops of Cretaceous clay, which have been extensively worked for raw material in the manufacture of fire brick, earthenware, and pottery; and wherever excavations have been made for this purpose remains of fossil vegetation have been brought to light. If these clays are theoretically extended to the eastward, in the direction indicated by their line of strike across New Jersey, they may be seen to touch Staten Island, a portion of the western end of Long Island, Block Island, and Martha's Vineyard; and it is at these localities that clays lithologically identical with those of New Jersey, and containing the same kinds of fossil plant remains, have been found.

In connection with this lecture we are especially concerned with the specimens from Staten Island and Long Island, and the local conditions under which they occur. On these islands there are certain geological features which do not obtain on the adjacent mainland of New Jersey. These features represent the records of glaciation left by the continental ice sheet of the Ice Age or Glacial Epoch, in its several advances and retreats over this region. The furthest southern extension of the ice front was in the vicinity of Prince's Bay, Staten Island, where the bluff that fronts on Raritan Bay represents the extreme southern salient of the terminal moraine. From there it bends abruptly to the northwest in New Jersey and to the northeast on Staten Island and Long Island. On the latter island it is represented by the range of high hills that constitute such a prominent and conspicuous feature of the northern part, fronting on Long Island Sound. In its advance the ice sheet profoundly modified or altered the topography of the regions over which it passed. In this vicinity it either eroded the clays entirely, as indicated by the basin of Long Island Sound, or else

it tore them up and pushed them ahead in contorted layers and broken masses and fragments, and left these as part of the material included in the terminal moraine.

On Staten Island and Long Island, therefore, the fossil plants that belong in these clays are not often found in undisturbed strata, as they are in New Jersey, but are mostly in more or less contorted beds or in detached masses or boulders of clay that are constituents of the glacial moraine. These clay fragments and boulders are usually more or less hardened and otherwise changed from their original condition and appearance. The first of these specimens that attracted serious attention were found in 1871, in Brooklyn, during the work of excavating for a gas house in the eastern district; but their identity was not established at the time and their significance was not appreciated. Similar specimens were found shortly afterwards on Long Island, at Lloyd's Neck and Glen Cove, and subsequently fossil leaves were found in the clays exposed at Northport and Cold Spring.

On Staten Island fossil plant remains were first found, in 1883, in connection with morainal material, at Tottenville, and subsequently in connection with the clays at Green Ridge and Kreischerville.

In the meantime the fossil flora of the New Jersey Cretaceous clays was being studied by Professor J. S. Newberry, the results of which were published in his "Flora of the Amboy Clays," issued in 1896 as volume 26, Monographs of the U. S. Geological Survey. With the aid of this work we were enabled to identify and to correlate many of the Staten Island and Long Island specimens with those from New Jersey, and to determine the Cretaceous age of our island specimens, and of the clays in connection with which they were found, either as morainal débris or in place.

The two localities that have yielded the largest number of specimens are Glen Cove on Long Island, and Kreischerville on Staten Island. At the former locality the clay—considerably contorted—is exposed in a bluff that fronts on Hempstead Harbor. The specimens may be found scattered along the beach, in ferruginous shale that represented altered parts of the clay, and also in coarser matrix that represents morainal débris. At Kreischerville the specimens were found in place, in the clay,

where it had been mined for commercial purposes. At this locality, in an excavation known as the Androvette pit, a rich deposit of fossil plant remains was unearthed that included leaves, fruits and seeds, lignite, and amber, many of which may be found described in a work entitled "Cretaceous Coniferous Remains from Kreischerville, N. Y.," issued as volume 3 of the Memoirs of The New York Botanical Garden.

Anyone who possess patience and a little field experience may be almost certain of finding specimens at the localities mentioned; and such specimens have a certain value that is lacking in specimens of living plants. Climatic conditions do not affect them. They may be collected at any time of the year; and their subsequent condition as museum specimens remains the same as when they were found.

The lecture was illustrated by lantern slides that depicted the geological conditions under which the plant remains occur; views of the principal localities on Staten Island and Long Island where specimens were collected; and representations of many of the specimens, including the results of studies of thin sections of the lignites with the aid of the microscope.

ARTHUR HOLLICK.

THE PRESENT STATUS OF EVOLUTION[1]

Evolution, said Dr. Cowles, may perhaps be satisfactorily defined as the unfolding or development of organisms as opposed to their sudden special creation and continued existence without subsequent modification. Evolution includes retrogression as well as progression. In the struggle for existence many organisms have gone downward, whereas many others have gone upward. The evidences for evolution are many. They come in part from the similarity of anatomy and body form that exists between organisms. It is hard to explain the similarity between different mammals, for example, without assuming a relationship existing between them, so similar are the parts of the body. The bones and the various organs of the higher mammals, including man, are very similar one to another. Another argument

[1] Abstract of a lecture by the head of the Department of Botany of the University of Chicago, at The New York Botanical Garden on Saturday afternoon, May 14, 1927.

for evolution is seen in the so-called vestigial organs which are best explained as relicts pointing to a former use. The gill slits and tail rudiments of man are splendid instances of this sort. Another evidence of evolution is seen in the similarity of blood tests as between the higher anthropoids and man. An extraordinary evidence of evolution is seen in the geologic record. The whole history of evolution of the horse and of many plants and animals is clearly depicted there. Unanswerable arguments in favor of the theory of evolution are afforded by changes that are taking place today beneath our very eyes. Within human history the modification of many animals, such as the dog, and many plants, such as the cabbage, are so great as to depict essentially specific change; at least such changes as these in nature would result in the plants and animals so changed being called separate species. One of the most frequent evidences of evolution is seen in the sports or mutations so frequently found in our gardens. The loganberry is a distinct development of our own time which arose as a sport or mutant of the California wild blackberry. Many such new forms are now known to exist. Their entrance into existence has been watched and studied. Finally, a word may be said about the relation between evolution and religion. There is no doubt of the reality of either and therefore there can be no conflict between them, for conflicts between two things both of which are true are quite impossible. Evolution is a fact and facts can not be hostile to religion or religion hostile to facts. Perhaps the chief opposition to the theory of evolution has been expressed by the so-called fundamentalists, but it should be noted as a final word that fundamentalists themselves are mostly evolutionists at heart, but have not thought the matter through. For example, most fundamentalists believe that the various divisions of the human race have come from a single pair. Most anthropologists likewise believe in the unity of the human race. In other words, both fundamentalists and men of science believe that all the divergences of the human race have come through evolution since the time when man could first be recognized as such. Such differences as are found between the yellow, red, white and black races have come through evolution and not through special creation. One may recognize in the white race great differences between

the Germans, Italians, Irish and French. One may even recognize differences in different parts of the United States. One may often distinguish a man from the south or a man from the east or north. Such differences are not due to special creation, but are due to evolution. In a sense, the fundamentalists may be regarded as more ardent evolutionists than are the men of science, since fundamentalists think of these great changes as having been brought about in less than 6,000 years, whereas the men of science regard such changes as requiring a vastly longer time.

HENRY C. COWLES.

THE ROCK GARDEN

When the additional 140 acres of land now in the southern part of the New York Botanical Garden came under the control of its managers, there was included a portion of a hill which had long been desired to complete what was then the "fern-garden." On the northern slopes of this hill, facing the Herbaceous Grounds, a small colony of the rock-polypody still persisted and our fern specialist, the late Dr. Lucien M. Underwood, had added other rock-loving species in one little corner. Geologically and botanically it seemed an ideally isolated area and suitable for a Rock Garden, so when the builder and originator of the Shakespeare Garden in Central Park begged to be allowed to make one, his request was gladly and promptly granted. The Rock Garden begins at the south-eastern corner with a level sunny stretch of ground, filled in with truck-loads of sand and gravel brought from the pine-barrens of New Jersey and planted with Bayberry, Bearberry, Blue-eyed Grass, Cacti, *Corema Conradii,* Sand Myrtle, Sweet Fern, and other characteristic sand-loving species, including the Bird-foot Violet.

The main path climbs up the hill in full sunshine and is bordered by some of the low-growing carpet-plants, such as Aubretias, Candytuft, Chickweeds, English Thyme, Golden Alyssum, several species of Moss- and Rock-Pinks, Cresses, Periwinkles, Saxifrage, and a few dwarf Iris. *Iris cristata* is one of these and seems to do very well among the rocks with a little moisture and good drainage. On the steeper slopes of the glaciated sum-

mit of the hill a few low groups of Alpine Heather, shrubby species of Azalea, Cotoneaster, Daphne, Euonymus, Jessamine, Columbines, Iceland Poppies, stone-crops, wild pinks, and many other interesting plants that will grow in crevices or upon sunny and exposed rock ledges have been assembled in places, where they are growing finely.

Meandering down from the summit, a little stream of water has been conducted through both artificial and natural channels,

FIGURE 4. Aubretia, etc., in the Rock Garden, May 9, 1926. Photograph by Miss Fleda Griffith.

making pools and shallows where moisture-loving plants, such as Forget-me-nots, some *Iris lacustris* from Lake Superior, find a congenial home. The natural channels are remnants of the glacial action which polished off the top of this little hill and others of similar form in other parts of the Garden[1] and form one of the most interesting of the natural features of this rock garden, giving as they do suggestions and associations with similar rock gardens in Switzerland and other parts of the Old

[1] See Arthur Hollick, Journal New York Botanical Garden, volume 27, December, 1926; idem, volume 26, January, 1925.

World. These channels have been utilized to conduct a stream of water down through the fern-garden, which occupies the northern and eastern slopes of the shaded portion of the enclosure. Among the ferns and along the banks of the little stream, groups of shade-loving plants, such as Jack-in-the-Pulpit, wild geraniums and violets, Cardinal Flower, Mertensias, and other native species are congenially placed and add a touch of nature which is both charming and soothing among the prevailing greens of the ferns. Here may be found many of our native species of ferns and a few hardy European and Japanese ones as well. A small bed of exotic primroses, squills, botanical species of tulips and daffodils, our own graceful little bleeding-heart from the southern states, *Bicuculla eximia,* Jacob's-ladder and masses of the pale violet-blue phlox, *P. divaricata,* seem happy in the shade of a large elm tree.

On the northwestern or cold and shady side of the Rock Garden, in pockets of wood-loam and duff, specially provided for them, have been planted a few of the rarer native species which are more difficult to grow. Here may be found the Trailing Arbutus, with Hepaticas, Bloodroot and Trilliums to shade and protect it. Also the southern *Galax* and *Shortia* among trailing colonies of Ground-pines or Lycopodiums and a few choice plants of the Twin-flower, *Linnaea americana,* sent down from his club by a good friend who goes fishing in Cape Breton or New Brunswick every year. Here also may be seen little groups of our most aristocratic Americans, some of the orchids. The early *Orchis spectabilis,* the pink and yellow Lady-slippers, Rattle-snake Plantain, Tway-blade and Coral root; as many of these shy and exclusive members of our local flora as can be induced to grow in an uncongenial climate and surroundings.

Between the stones that border the whole enclosure, graceful clumps of sedges, grasses and yarrow have been used most effectively to cover and conceal them. Along the paths, periwinkles and phloxes, *Cerastium tomentosum,* and candytufts, both white and purple, trail down into the path. No attempt has been made to purchase or grow many of the rare alpine plants of Europe. Of course, with more labor and more funds this garden could be greatly improved. Some attempt at a weekly or monthly "color-scheme" could be achieved by careful and

well-considered transplantings, but it is well known that at Kew and other large rock-gardens the plants are allowed to seed themselves naturally and are then thinned out from undesirable locations. Intelligent weeding of rock gardens is one of the difficulties of their maintenance.

Considering that the total expense of this garden has been thus far very small and that most of its growth and interest is due to its indefatigable custodian, we take this opportunity of congratulating him on his success and thanking him for his unselfish and untiring devotion. Also to thank those generous patrons who have contributed plants and funds to enable him to achieve in a few years' time so remarkable an assemblage of unusual plants and to cover a bare and neglected hill with beautiful and interesting rock species.

ELIZABETH G. BRITTON,
Honorary Curator.

THE TEA GARDENS OF CEYLON AND JAPAN[1]

By tea is meant the dried leaves of the tea plant, *Thea sinensis*. There is some doubt about the actual native home of tea, but it is known to have been in cultivation in China since about the fourth century, and in Japan since the ninth century. Because of the demand for it, it was introduced into Java in 1826 and into India in 1827. While early attempts were also made to establish its cultivation in Ceylon, it was not grown there on a large scale until after the collapse of the coffee industry forty or fifty years ago. Since then its cultivation has made rapid progress and now thousands of acres are devoted to it. The chief source of American tea is now Japan and Ceylon, although Chinese and Indian teas still have a great commercial importance.

In nature, tea becomes a small tree, but in cultivation it is kept pruned into a low bush,, seldom more than three to five feet high. At intervals during the year, depending somewhat on the occurrence of rains the stems of the tea plant start new growth, known as flush, and at this stage the tea is ready for picking. Only the tips of the stems are taken, including the terminal bud and not more than three young leaves just below it.

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, April 23, 1927.

Either black tea or green tea may be made from the same plant, depending on the treatment of the leaves after picking. The manufacture of green tea is the simpler process, and the finished product is ready for market in twenty-four hours. As soon as the tea leaves are brought into the factory, they are spread on large trays and heated until their edges turn reddish-brown. They are next passed between rollers, revolving in opposite directions, by which they are rolled up in the form familiar to us. They are next dried by blasts of hot air in special drying ovens, and are then ready for sorting. For the production of black tea, the leaves are spread on trays and allowed to wilt for about twenty-four hours. They are next passed through the rollers, and then again spread out on trays and allowed to ferment, a process which requires from two to six hours and during which they become dark in color. They are then rolled again and finally dried in the usual drying ovens.

For both sorts of tea, the next process is sorting, which is accomplished by passing the leaves through sieves with various sizes of mesh. The smallest and youngest leaves pass through the finer meshes and constitute the choicest brands, while the older and larger leaves, with less attractive flavor, pass only through the larger meshes. The various kinds of tea, such as oolong, English breakfast, pekoe, souchong, and several others, refer partly to size of the tea leaf, partly to the method of manufacture, and in some cases to the district where it was produced. An average yield of tea is about four hundred pounds per acre.

PLANTING OF YOUNG HEMLOCKS IN THE HEMLOCK GROVE

In the January, 1926, issue of this Journal (**27**: 6–9), record was made of an attempt to aid the natural propagation of hemlock trees in the Hemlock Grove, by the planting, on November 23, 1925, of 100 seedlings of the second year, in an area near the northwestern border of the grove. The result has been observed from time to time; a count on May 16, 1927, showed that only 15 of these seedlings have survived; many were detached from the soil by the thawing of the forest floor in the spring of 1926; others succumbed during the summer. The experiment of autumn planting was therefore unsatisfactory.

On May 16, 1927, an experiment with spring planting was made in another area, west of the waterfall in the Bronx River, 117 seedlings of the second and third years being used. This area differs from the first one planted by being less shaded and more undulating. The identification of this area is safeguarded by the presence during the planting of Mr. Barrington Moore of the Board of Managers, Mr. John F. Walsh and Mr. William Reichelt of the Park Department of the Bronx, Mr. Boynton, Head Gardener, Mr. Corbett, Superintendent of Buildings and Grounds, and Mr. Finley, Foreman Gardener.

During the course of the 1927 planting a good many natural seedlings of hemlock were noticed. It is interesting that these were of different ages, from those which have just come up, to about 10 years or older, showing that some hemlock reproduction becomes established every year, or every few years, instead of at long intervals as with certain other trees. A permanent quadrat of a square meter was staked out, on which natural seedlings of various ages were represented. The survival and development of these seedlings will be recorded from time to time.

N. L. Britton,
Barrington Moore.

BEQUEST OF DR. GEORGE NEWTON BEST

Dr. George Newton Best, for many years an enthusiastic botanist, and a critical student of mosses, one of the older members of the Torrey Botanical Club, died at his home in Rosemont, Hunterdon County, New Jersey, June 18, 1926, in his 81st year. As a young man he was a teacher, and a student in Lafayette College, where he came under the influence of the distinguished Professor Thomas Conrad Porter. He was graduated in medicine from the University of Pennsylvania in 1875, and at once began practice at Rosemont, and continued in his profession there until his death.

For many years he was a diligent student and collector of the Flora of Hunterdon County, New Jersey, and contributed many specimens and records to the Catalogue of the Plants of New Jersey, published by the State Geological Survey in 1890. He also gave much attention to the wild roses of North America.

His studies of mosses have extended over thirty years, and he accumulated a large collection of these plants. His will provides for their preservation as follows:

"I give and bequeath to the Trustees of The New York Botanical Garden, Bronx Park, New York, and their successors in office, Three Thousand Dollars, and my collection of mosses on condition that the said Trustees shall have the mosses properly named, placed in order and deposited in the herbarium."

At a meeting of the Board of Managers of The New York Botanical Garden held November 18, 1926, the following resolution was adopted:

"*Resolved,* That The New York Botanical Garden accept the said bequest under the terms of Dr. Best's last will and under the conditions stated, and agree that the mosses shall be properly named, placed in order and deposited in the herbarium."

The mosses and also his collection of roses were transferred to the Museum Building of the Garden soon after his death and their distribution into the herbarium commenced by Mr. R. S. Williams, and since continued. A check for $3,000 was received from his executors on March 8, 1927.

N. L. BRITTON,
Secretary.

PUBLIC LECTURES DURING JULY AND AUGUST

The following is the program of the illustrated lectures at The New York Botanical Garden for the months of July and August. The lectures are given in the Museum Building on Saturday afternoons, beginning at 4 o'clock. Doors are opened at 4:15 to admit late-comers.

July	2.	"Lilies,"	Dr. A. B. Stout.
July	9.	"Landscape Treatment of Small Grounds,"	Miss Elsa Rehmann.
July	16.	"Scenery and Flora of North American Mountains,"	Mr. Raymond H. Torrey.
July	23.	"Rock Gardens,"	Mr. Montague Free.
July	30.	"American Botanists of the Past,"	Dr. J. H. Barnhart.

August 6. "Planning Next Year's Rose Garden,"
Prof. Hugh Findlay.
August 13. "Hastening the Life Activities of Plants by Chemicals," Dr. F. E. Denny.
August 20. "The Trees of Greater New York,"
Dr. Arthur H. Graves.
August 27. "Gladioli," Mr. Kenneth R. Boynton.

NOTES, NEWS, AND COMMENT

During the present season the Board of Managers and the Advisory Council of The New York Botanical Garden have issued special invitations to members and their friends to view floral displays as follows: Daffodils, April 29; Tulips, May 6; Iris, June 2; and Roses, June 24.

During May, Mr. E. J. Schreiner was in Maine in charge of the field planting of poplars and the starting of a nursery which is to provide for further planting for pulp-wood reforestation. The 5,000 poplar hybrids obtained in the breeding work of 1925 were taken to Maine and over 300 of them were selected for propagation. Dr. A. B. Stout spent a few days in Maine on an inspection of this work, which is a project being conducted in coöperation with The Oxford Paper Company.

Dr. Arthur Hollick was in attendance at the twenty-second annual meeting of the American Association of Museums, held in Washington, D. C., May 23 to 25. Meetings were held each day in the Smithsonian Institution, the American Red Cross National Headquarters, and the Corcoran Gallery of Art, respectively, and round table discussions were held in the evenings at the New Willard, the hotel headquarters. About 100 members and guests were present.

Nearly fifty delegates from foreign countries, en route to attend the First International Congress of Soil Sciences held in Washington, D. C., June 12 to 22, visited The New York Botanical Garden June 8. The members of the party were the guests

of Dr. N. L. Britton at a luncheon at Sormani's restaurant. The afternoon was spent in the Garden, with a walk through the hemlock grove, a trip by motor cars through most of the grounds, an inspection of the library, laboratories, and herbarium in the Museum Building, and a visit to the greenhouses of Conservatory Range No. 1.

Ellen Eddy Shaw, Curator of Elementary Instruction at the Brooklyn Botanic Garden, lectured on "Children's Gardens" at The New York Botanical Garden on the afternoon of April 30. This talk was illustrated by about fifty lantern slides, showing children in the various stages of making their gardens, from the time of spading up the little garden plots to the time when the crops are gathered. The talk included advice given to children on the care of a garden, most satisfactory crops to raise, the flowers best suited to city yards. While this lecture was intended primarily for children, it was helpful to all adults starting gardens for the first time.

Among the visitors to the library who enrolled during the spring were the following botanists: Dr. Caroline A. Black, Connecticut College, New London, Conn.; Prof. H. H. Whetzel, Ithaca, N. Y.; Prof. A. P. Kelley and class, New Brunswick, N. J.; Prof. Geo. H. Shull and class, Princeton, N. J.; Dr. Francis W. Pennell, Philadelphia, Pa.; Dr. Edgar T. Wherry, Prof. R. Kent Beattie, Messrs. Fred C. Meier, Roy G. Pierce, O. F. Cook, and C. B. Doyle, Washington, D. C.; Prof. Alfred C. Hottes, Ohio State University, Columbus, Ohio; Prof. Paul W. Graff, Missoula, Mont.; Prof. Douglas H. Campbell, Stanford University, Calif.; Brother León, Colegio de la Salle, Havana, Cuba; Dr. T. Miyake, Formosa, Japan, and Kametaro Ohara, College of Commerce, Nagoya, Japan.

Professor Alfred C. Hottes, the well-known horticulturist of the Ohio State University, gave an illustrated lecture at The New York Botanical Garden on Saturday afternoon, May 28, on "New Varieties of Old Perennials." Professor Hottes is the author of "The Little Book of Perennials," "The Little Book of Annuals," "The Little Book of Climbing Plants," and "1,001 Gar-

den Questions Answered." Each year, said Professor Hottes, brings new flowers to our gardens—larger or more beautiful in color. The progressive gardener takes more delight in testing a new plant than in seeing the growth of the many reliable plants which usually make up a successful garden. It is as necessary to keep in style in the garden as it is in clothes, houses, or automobiles. When the flower lover knows flowers by name as he knows the names of his friends we shall have a more beautiful garden country. The garden lover will never be content until he has induced every neighbor and friend to share with him the exasperating joy of a garden. The love of flowers is innate in our natures but the countryside will not be more beautiful until every lover of flowers does his bit to beautify his window sill, his dooryard, or his place of business. Professor Hottes showed several hundred pictures of perennials from his large files of garden flowers. At the Ohio State University there is a three-acre garden of perennials, annuals, evergreens, and choice shrubs.

Dr. Clara Barrus lectured on the afternoon of April 9, in the Museum Building of The New York Botanical Garden, Bronx Park, her subject being "With Burroughs and Muir in the Southwest." Dr. Barrus is the biographer of John Burroughs, and has also written several articles on John Muir; her writing of these well-known naturalists is based on a long acquaintance with them, and particularly on having been with them during three successive years on the Pacific Coast. She gave intimate glimpses of the two great naturalists who have so abundantly interpreted Nature in America—Burroughs more particularly on the Atlantic seaboard, and Muir on the Pacific. She evidently improved the exceptional advantages offered her in traveling with John o' Birds and John o' Mountains, and while they were exploring the many strange corners of our country and absorbingly studying the wonders, she must have studied the students, for in observation, description, and anecdote she brought these two men vividly before her hearers. Though so at one in their interest in Nature, they were very different in appearance, temperament, and character. The lecture was enlivened by many touches of humor, as well as by vivid characterizations of Burroughs and Muir. About ninety colored slides were shown by the lecturer. They pictured favorite

haunts of John Burroughs in the East, with eastern fauna and flora; then the journey across the states, with picturesque scenes in New Mexico and Arizona, the Desert, the Petrified Forests, the Grand Canyon, Southern California, and Yosemite Valley, followed by many scenes in the Hawaiian Islands, notably in Honolulu, and the great extinct crater of Haleakala on Maui, and the great active volcano, Kilauea on Hawaii.

Meteorology for May. The total precipitation for the month was 5.28 inches. The maximum temperatures recorded at the Garden for each week were 74° on the 7th, *80.5° on the 11th,* 75° on the 20th, and 76° on the 23rd. The minimum temperatures were *43° on the 3rd,* 45° on the 14th, 45° on the 21st, and 44° on the 28th.

ACCESSIONS

MUSEUMS AND HERBARIUM

5 specimens of *Zamia* from Mexico. (Given by Professor Charles J. Chamberlain.)

109 herbarium specimens of flowering plants from eastern North America. (Given by Dr. H. M. Denslow.)

396 specimens of flowering plants from Uruguay. (Collected by Dr. Guillermo Herter.)

1 specimen from the type of *Juncus tenuis.* (Given by Mr. K. K. Mackenzie.)

70 specimens of flowering plants from northern Ontario. (Collected by Mr. Edgar Anderson.)

122 specimens of flowering plants from California. (By exchange with the University of California.)

4 specimens of orchids from North Carolina. (Given by Dr. Edgar T. Wherry.)

2 specimens of *Dasystephana tenuifolia* from Florida. (Given by Professor Hermann Kurz.)

100 specimens of flowering plants from Massachusetts. (Collected by Mr. F. C. Seymour.)

200 specimens of flowering plants from the Canadian Rocky Mountains. (By exchange with the University of Minnesota.)

1 specimen of *Amphiglottis conopsea* from North Carolina. (Given by Mr. Willard N. Clute.)

29 specimens of flowering plants from Utah. (By exchange with Professor A. O. Garrett.)

450 specimens of Brazilian plants. (By exchange with Riksmuseum, Stockholm.)

10 specimens of flowering plants from Alberta, Canada. (By exchange with Mr. R. D. Dixon.)

9 specimens of flowering plants of eastern North America. (Given by Professor F. S. Beattie.)

161 specimens of aquatic plants from Germany. (Professor Hugo Glück.)

1 specimen of *Ivesia Chandleri.* (Given by Dr. Anstruther Davidson.)

12 specimens of flowering plants from Nebraska. (Given by Professor N. F. Peterson.)

25 specimens of fungi from Winnipeg, Canada. (By exchange with Dr. G. R. Bisby.)

118 specimens of fungi from Utah. (By exchange with Professor A. O. Garrett.)

20 specimens "Fungi Wisconsinenses Exsiccati," decades 14 and 15. (By exchange with Dr. J. J. Davis.)

25 specimens of fungi from Canada. (By exchange with Dr. G. R. Bisby.)

1 specimen *Ascomycetella filicina* from Trinidad. (By exchange with Dr. Roland Thaxter.)

1 specimen of *Clematis orientalis* from Colorado. (Given by Professor William Trelease.)

53 specimens of flowering plants from Greenland. (By exchange with the University of Copenhagen.)

1 specimen of *Hymenocallis Crandallii* cultivated at Valladolid, Yucatan. (By exchange with the United States National Museum.)

1 specimen of *Scirpus bernardinus* from California. (Given by Professor Philip Munz.)

87 specimens of flowering plants from Brazil. (By exchange with the Riksmuseum, Stockholm.)

2 specimens of *Prunus* from Texas. (Given by Professor D. A. Saunders.)

6 specimens of *Iris verna* from Wilmington, N. C. (Collected by Mr. E. J. Alexander.)

1 specimen of *Alyssicarpus nummularifolius.* (Given by Mr. Berlin Hart Wright.)

1 specimen of *Helianthus Maximiliani* from Michigan. (By exchange with Dr. J. H. Ehlers.)

69 specimens of flowering plants from Cuba. (By exchange with the Riksmuseum, Stockholm.)

4 specimens of *Hartwrightia floridana* near DeLand, Florida. (Given by Mr. Berlin Hart Wright.)

8 specimens of *Tillandsia Baileyi* from Texas. (Given by Mr. Robert Runyon.)

4 specimens of marine algae from Chile. (By exchange with the United States National Museum.)

1 specimen of *Mougeotia* from New Hampshire. (Given by Mr. Lawrence R. Blinks.)

4 specimens of coralline algae from New Brunswick. (Given by Mr. Frits Johansen.)

3 specimens of marine algae and one moss from Colombia. (By exchange with the United States National Museum.)

39 specimens of marine algae from Atlantic City, N. J. (By exchange with the United States National Museum.)

119 specimens of marine algae from the Dry Tortugas, Florida. (By exchange with Professor William Randolph Taylor.)

1 specimen of *Riccia fluitans* from Florida. (By exchange with the United States National Museum.)

45 specimens of Triassic and Jurassic fossil plants. (By exchange with the Riksmuseum, Stockholm.)

1 specimen of *Asterella tenella* from Arkansas. (Given by Mr. A. T. Beals.)

6 specimens of travertine-forming blue-green algae (*Plectonema* sp.?) from Death Valley, California. (Given by Dr. W. T. Swingle.)

1 specimen of *Zoochlorella parasitica* from Canada. (Given by Prof. Jacques Rousseau.)

2 specimens of marine algae from North Greenland. (By exchange with the United States National Museum.)

1 specimen of *Blepharostoma arachnoideum* from Lewis Co., Washington. (Given by Dr. George H. Conklin.)

1 specimen of *Dothidella Laminariae* from Orient, N. Y. (Given by Mr. Roy Latham.)

7 specimens of *Gymnogongrus* from California. (By exchange with the University of California.)

105 specimens of marine algae from Hudson Bay. (Given by Mr. Frits Johaansen.)

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Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Vol. VII. Includes New Myxophyceae from Porto Rico, by N. L. Gardner; The Flower Behavior of Avocados, by A. B. Stout; Descriptions of New Genera and Species of Plants Collected on the Mulford Biological Exploration of the Amazon Valley, 1921–1922, by H. H. Rusby; and The Flora of the Saint Eugene Silts, Kootenay Valley, British Columbia, by Arthur Hollick. viii + 464 pp., with 47 plates, 10 charts, and 11 text-figures. 1927.

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 35,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific, and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated undor the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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JOURNAL
OF
THE NEW YORK BOTANICAL GARDEN

THE JAMES PALMETTO—SABAL JAMESIANA
JOHN K. SMALL

THROUGH THE ANDES OF WESTERN COLOMBIA
FRANCIS W. PENNELL

COFFEE: THE PLANT AND THE BEVERAGE
RALPH H. CHENEY

WISTERIA
EDMUND H. FULLING

SOME GEOLOGICAL FEATURES OF THE NEW YORK BOTANICAL GARDEN
ARTHUR HOLLICK

THE FRANCIS LYNDE STETSON FUND
N. L. BRITTON

NOTES, NEWS, AND COMMENT

ACCESSIONS

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THE JAMES PALMETTO SABAL JAMESIANA

As recently recorded,[1] the palmetto-palm (*Sabal texana*) was, as far as the evidence goes, the first palm observed by a European on the North American mainland. This discovery was before the beginning of the sixteenth century, for the map on which the name Rio de las Palmas—now the Rio Grande—was published, appeared in 1502. This so-called palmetto-palm is the only palm growing in the part of Texas and adjacent Mexico about the mouth of the Rio Grande. Only two kinds of palms grow naturally in Texas, the second one being the dwarf palmetto (*Sabal minor*). On the other hand, more than a dozen kinds of palms grow naturally in Florida, the region here directly under consideration. Florida has been referred to as the "Land of Flowers," and the "Land of Ferns." It may be justly called the "Land of Palms," for thirteen of the sixteen different species of the native palms of the continental United States are native, not only in the Peninsular State, but in the Florida peninsula and the adjacent Keys alone. Eight species (*Cocos nucifera, Pseudophoenix vinifera, Roystonea regia, Sabal minor, S. Palmetto, Thrinax parviflora, Paurotis Wrightii, Rhapidophyllum Hystrix*) are typically hammock inhabitants. Four species (*Sabal Etonia, Thrinax microcarpa, Coccothrinax argentea, Serenoa repens*) are typically pineland inhabitants. In the matter of exceptions, the cabbage-tree (*Sabal Palmetto*) is not rare in the pinelands, while the Key-thatch (*Thrinax microcarpa*) and the saw-palmetto (*Serenoa repens*) grow to some extent in hammocks. The hammock inhabitants have been in the majority and their number must now be increased by another palm:

[1] Journal of The New York Botanical Garden **28**: 132. 1927.

Sabal Jamesiana Small, sp. nov. Tree up to 5 m. tall, the stout trunk usually 1–3 m. high, usually clothed with the persistent leaf-bases: leaves loosely spreading in all directions, mostly 2–4 m. long; petiole slender, pliable, about as long as the blade or usually longer, the ligule narrowly lanceolate, inequilateral; blade longer than wide, usually 1–1.5 m. long, flat, relatively finely ribbed, with the very numerous (70–100) segments much shorter than the undivided part, pliable and gracefully curving or drooping, sparingly filiferous: spadix about 1 m. long, much branched: flowers smaller than in *S. Palmetto:* calyx nearly 2 mm. long; lobes broadly ovate, nearly as long as the tube, black-tipped: petals oval-ovate, about 3 mm. long, cream-colored: filaments nearly as long as the petals, stout-subulate: anthers ovate-sagittate, much shorter than the filaments, blunt: drupe depressed, mostly 7 9 mm. in diameter, black: seed depressed, mostly 12–14 mm. in diameter, black: seed much depressed, 9–10 mm. broad, nearly black.—Hammocks, Everglade Keys, Florida. The plant is named for Mrs. Arthur Curtiss James, a patron of botany and horticulture.

Although somewhat aberrant, this palm belongs to the subgenus *Inodes.* It has the midrib prolonged far into the leaf-blade, but the midrib is straight and the blade is not folded backwards along the midrib. The ample, relatively slender-petioled leaf-blades, with the large flat unparted portion and the short narrow numerous pliable lobes, drooping backwards or forwards, are quite different from the leaves of any palm in the United States. Altogether it is a less robust and vigorous tree than *Sabal Palmetto,* and a shy bloomer, whereas *S. Palmetto* is a prolific bloomer.

The genus *Sabal,* in the continental United States, has the widest geographic distribution and the greatest number of species of any of the genera. Collectively the genus extends from Cape Sable, Florida, to Cape Hatteras on the North Carolina coast (*Sabal Palmetto*) and to Point Isabel on the Texas coast (*Sabal texana*). In the Cape Sable region it mingles with palms of other genera. At its northern and its western limits the genus is an isolated palm. The Florida peninsula is the intensive center of its geographic range. There, four different species mingle. An isolated species (*Sabal Deeringiana*) inhabits the Mississippi delta. The type of the genus, the blue-stem (*Sabal minor*), occurs in every one of the South Atlantic and Gulf States.

Unlike the case of the Texas palmetto, it is impossible, with such a line-up of genera and species, to tell which of the Florida palms was the first to be observed by a European, nor would the

FIGURE 1. In a hammock on the edge of the Everglade Keys west of Kendall, Florida. Plants of *Sabal Jamesiana,* showing the large flat leaf-blades with the very numerous ribs and correspondingly numerous relatively short pliable drooping lobes. By these leaf-characters, the short spadix, and the much depressed fruits, *Sabal Jamesiana* may be distinguished from *Sabal Palmetto,* which also grows in and about this hammock as it does also in the other hammocks where the James Palmetto occurs.

fact be of special interest, for nothing of direct historical or geographical interest hinges on it, as in the case of the Texas palmetto. Although shortly after Florida was christened by De Leon (1513)[2] temporary residents thereof, so to speak—white captives of the aborigines -made mention of the natural history of the regions covered in their wanderings, and references to palms are numerous. The first white man to write about the Miami region, where *Sabal Jamesiana* is endemic, Hernando de Escalente Fontaneda,[3] who was held a captive for nearly two

[2] Juan Ponce de Leon was born about 1460 in Leon, Spain. In his youth he became a soldier, engaged in wars against the Moors; in 1493 he accompanied Columbus on his second voyage, visiting Hispaniola; in 1502 he returned to Hispaniola with Ovando, and became governor of the eastern part of the island; in 1510 he was appointed governor of Porto Rico, which he had visited two years before; it was there that he heard from the natives of the fabulous island of Bimini, to the northward, with its wonderful fountain of outh. Sailing in search of this fountain, he left Porto Rico 3 March, 1512; 24 days later, 27 March, 1513 (25 March was then New Year's Day) he sighted the coast of Florida. Sailing along the coast, he landed 8 April, a short distance north of the present site of St. Augustine, and took possession in the name of the king and queen of Spain. He then sailed southward along the coast, returning to Porto Rico, and thence to Spain. In 1514 he was appointed governor of Bimini and Florida, but made no further attempt at exploration in that direction until early in 1521; in that year he set sail from Porto Rico with a large number of colonists and attempted a settlement on the coast of the island (which he always supposed it to be) of Florida, but was driven off by the natives In the conflict he was wounded by an arrow, and as a result of this wound he died soon afterwards, in July, 1521, in Cuba. JOHN HENDLEY BARNHART.

[3] Hernando de Escalante Fontaneda was born about 1538, at Cartagena, Colombia, where his father was one of the earliest settlers. In 1551, at the age of thirteen, he was put on board a vessel bound for Spain, there to receive his education; but the vessel was wrecked on the west coast of Florida, and most of the passengers and crew were murdered by the Indians. The boy, however, was held as a captive for fifteen years or more, learning several Indian languages, visiting various parts of the peninsula, and serving at times as interpreter between the Indians and Spanish castaways. It was probably in 1566 or 1567, when the governor, Pedro Menendez Aviles, visited the Tampa Bay region, that Escalante Fontaneda was released from his captivity. He subsequently went to Spain, where, in 1575, he wrote an account of Florida and its inhabitants; this, however, contains few details of his own life while there. His subsequent history seems to be unrecorded.—J. H. B.

decades and wandered over a large part of the Florida peninsula in company with the aborigines, doubtless observed every kind of palms native to the region he covered in his travels. In writing of the region under consideration—the Bay Biscayne region, Fontaneda says: "The Martires (Florida Keys) end near a village of Indians called Tequesta (Miami), situate on the bank of a river which comes from the interior and issues from another lake of fresh water (Everglades), which is said by some Indians who have traversed it more than I, to be an arm of the Lake of Mayaimi (Lake Okeechobee). On this lake, which lies in the midst of the country, are many towns, although of not more than thirty or forty souls each, . . ."

Fontaneda in visiting the towns just referred to, one or more times, very likely, went to the town on the edge of the Everglades west of the present town of Kendall. This aboriginal settlement was evidently large and active. Besides mounds, other evidences of ancient occupation are evident, *viz.*, old fields, canoe-landings, pottery, etc. The natural position and configuration of the land there, destined it to be a large settlement. It was an outlet for travel, by water to the south, west, and north. But more determining perhaps was its proximity to the eastern coast. It was not only the nearest shore of the Everglades to the shores of Bay Biscayne, south of Miami, and to the Florida Keys, but there were several "glades" (channels) which gave the inhabitants easy access to their maritime neighbors, friends or enemies, on the shores of Bay Biscayne and the adjacent islands.

As far as we know, the palm here named and described for the first time is more plentiful in this so-called Kendall hammock than in any of the other hammocks of the Everglade Keys. Although *Sabal Jamesiana* is most abundant in the Kendall hammock, it also grows in the James hammock on Snapper Creek and in the Deering hammock at Cutler.

JOHN K. SMALL.

THROUGH THE ANDES OF WESTERN COLOMBIA[1]

I. *Introductory. Scope of expedition and specimens obtained.*

From May to October, 1922, the speaker and his associates were gathering specimens of the flora of western Colombia on behalf of The New York Botanical Garden, United States National Museum, Harvard University, and the Academy of Natural Sciences of Philadelphia. Besides the speaker and Mrs. Pennell, those in the party were Mr. Ellsworth Killip of the United States National Museum and Dr. Tracy E. Hazen of Columbia University. The last was with the party only two months, but to his skill in photography is due the obtaining of some remarkable reproductions of the plant-life of the high Andes. Mr. Killip, who was especially skilled in the preparation of beautiful specimens for the herbarium, is (March 19, 1927) again in Colombia, and his new acquisitions from the northern Eastern Andes are being awaited with interest.

Before narrating the journey of 1922, the speaker stated that during five months in Colombia over 22,000 speciments were gathered, an average of about 140 each day. (As a single specimen is considered the portion of each collection assigned to a single museum, whether this be a branch of a tree with flowers or consists of several small herbs). Over 7,000 collections were made, representing probably 3,000 to 4,000 species. During the four years since the expedition's return nearly half of the plants have been identified by various botanists, who have already discovered in the series nearly 250 species new to science. As, in many instances, well-known plants have been named and little-known or unknown plants put aside for further study, it is probable that the total number of new species in this Colombian series will be several times this figure. Certainly more than one out of every ten species gathered will prove hitherto unknown to scientists.

II. *Into the Western Andes from the Pacific Coast.*

With the aid of lantern slides the speaker followed the expedition's route in Colombia. Landing at Buenaventura on the

[1]Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, March 19, 1927.

Pacific Coast, one passes at once into humid tropical forest, the wettest in the Western Hemisphere. Tropical families of trees such as Rubiads and Melastomads abound there, the leaves of many prolonged into slender tips from which drips off the excess of water. Palms, bamboos, and large-leaved relatives of the banana are conspicuous. Noticeable are heavy vines, and especially the Aroids with their huge leaves. Then, as the train takes one rapidly through the narrow curving gorge of the Dagua River, the heavy forest is left behind and one passes out into a broad grass-covered valley, the floor and sides of which bear large cacti of several kinds. Although this arid valley is just over a low ridge from the wettest forest in America and likewise receives its winds from the Pacific Ocean, little rain ever falls; the reason being that the ridge intercepts and precipitates the water borne by the continual west winds.

Above the valley on the summit of the Western Andes, once again in forest because now higher than the outlying ridge just mentioned, is La Cumbre. Here, using an American hospital for a base, rich collections were obtained in the forests that clothe the middle elevations of the Andes. In this "subtropical zone" one forgets the heat of the lowland, and its plagues of insects, snakes, etc. The flora contains many tree-ferns, many tubular red flowers visited by humming-birds, and numerous kinds of orchids that grow as air plants on the limbs of trees.

III. *To Popayán, a gem of Spanish America.*

Descending into the deep trough of the Cauca Valley, lying between the Western and Central Andes, mules for riding and cargo-carrying were purchased, and the expedition started southward for Popayán. This city, at the head of the Cauca valley, was, in the speaker's opinion, the choicest cultural center that he has ever visited in Spanish America. The party were guests of the estate of El Cauca and lived in the beautifully austere convent, once occupied by the Carmelites but confiscated by the liberal president Mosquera about the middle of last century. The old university, the churches with treasures more beautiful and ancient than seen elsewhere, the musical concerts of Popayán, must always be remembered—it is characteristic of the city (and an interesting instance of Colombian culture), that, although only

a city of a few thousand population and located two days' journey by mule-back from the nearest railroad, Popayán should possess three orchestras. Here we met Don Guillermo Valencia, Colombia's leading poet; and it was by his invitation that we visited Paletará.

From Popayán excursions for plants were made to the east, up to the ash-covered slopes of the smoking volcano of Puracé and to the beautiful cold forest and páramo of Paletará, in the Central Andes; and to the west, to the bushy summit of Santa Ana, in the Western Andes, from which one looks over the wholly forested valley of the Rio Micay and out beyond a spur of the range to the far-away Pacific. Mr. Killip descended for a few days into the forest of the Micay, living with the Indians, and bringing back some of the most interesting and novel plants obtained by the expedition. The speaker remained in the cool forests near the summit of the Western Andes, gathering orchids of many wonderfully exquisite sorts, all seeming to be now in their time of bloom.

IV. *To the Snow of the Quindio.*

After returning from Popayán to La Cumbre after Mrs. Pennell had started on the return to the United States and Dr. Hazen had joined the party, the three botanists descended the Cauca River to Zarzal, rode eastward to Salento, and the speaker spent several weeks on the estate of Don Alfonso Tobón (an author and nephew of the president of Colombia) in the cold upper zone of the Central Andes, here called the Quindio. His companions crossed the Central Andes on the historical Quindio Trail but Dr. Hazen returned to join in the adventures following. As guests of Sr. Tobón they camped with a party of his friends on the "páramo," as the open land above timber is called, and thence climbed the little distance still remaining to the snow fields of the glacier-covered crown of El Quindio. Particular study was made of the plant-life of the páramo, and illustrations were shown of the different methods by which plants are enabled to grow under temperatures of freezing perhaps every night. Many are dwarfed, some spreading to form mats, and some forming coralline hard clumps that harbor in their interstices various minute plants. Most striking however are the plants that grow

upright, but are protected by dense coats of hair. Certain lupines are so protected, but the most characteristic of these plants are the " frailejones," heavy-stemmed plants from one to six feet tall, the woolly leaves spreading in a crown from the summit, the stem covered and protected by the deflexed old leaves. A lower plant (*Culcitium* or white frailejon) with a coat of woolly hairs more dense than the speaker had ever seen on any other plant, was able to grow yet higher, almost or quite to the snow.

V. *Geographical Interest of the Flora of the High Andes.*

There are three ranges of the Andes in Colombia, all connected by subtropical forest, but each with isolated cold forest and páramos, and the Western Andes is further broken into several island like high areas. A map, from the rare Colombian atlas of Vergara y Velasco, was shown, indicating with great fidelity the occurrence of these cold highlands. The speaker, from his experience of thirteen months upon all the three cordilleras of the Andes of Colombia, told of how certainly one might predict upon each isolated highland a peculiar flora, and showed in illustration the distinct frailejones of the Eastern and Central Andes. Even more certainly would one find on each such area peculiar species of the Andean slipper-flower, or *Calceolaria,* and of the shrubby lobelias, or *Centropogon.* The several highlands of the northern Western Andes are the least known although the richest in local plants. They are difficult of access, but have been twice climbed by the speaker, once at their northern extremity after a journey by dugout canoe and foot-path of nearly two weeks from Montería on the Sinú and in 1922 across the Cauca Valley by a shorter but yet more difficult ascent to the páramo of Corro Tatamá. On both these climbs the floras of the cold forest and páramo consisted largely of plants unknown to science. To finish the exploration of the high uplands of the northern Western Andes would not only reveal more plants as yet unknown, but by a comparative study of the plants of these and of the other high areas of the Colombian Andes we would be able to decide which floras have special affinity. Such knowledge would help us to understand the geologically recent history of the Northern Andes.

FRANCIS W. PENNELL.

COFFEE: THE PLANT AND THE BEVERAGE[1]

Coffee has been in use for centuries and the term itself is more ancient than the beverage. The word has been derived from the Dravidian languages of Southern India, which antedate the Hindu and Sanskrit. The Dravidian term Kaḍu has the subsequent derivatives: Kaṭu (Sanskrit), Kaṛwa (Hindu), Qahwah or Kahwah (Arabic), Kawa (Polynesian), Kahveh (Turkish), caffe (Italian), kawphy (Old English), cauphe, cohpie, or coffey (Middle English variations), and the modern term coffee. The original terms are much earlier than the use of coffee. Throughout their history these terms have always applied fundamentally to a quality, not a specific plant or beverage. In every instance, the names referred to a plant or beverage with a bitter or pungent quality. It was without doubt in reference to the pungent wines that the Arabians became familiar with the term; and, upon acquiring a taste for coffee which was, and still is, prepared by them as a thick, black, and bitter beverage, they merely transferred to their new preparation the name of their common and bitter drink.

Whether the discovery of coffee as a beverage was made by the exiled dervish, Hadji Omar, who ate the pulp and roasted and steeped the seeds in water to allay his thirst and thereby became aware of the pleasing drink and introduced it into Arabia upon his return; or, whether an Arabian mollah named Chadeley observed that his goats, having browsed on the leaves and fruits of a certain tree, became excited, and therefore Chadeley gave an infusion to his monks to test its virtue and to stimulate them to keep awake during nocturnal devotions and resulted in the monks becoming inveterate coffee-drinkers; or whatever the origin of its use may have been, we know that since the thirteenth century the Arabs have sworn alike by Allah and by Coffee.

When coffee was introduced from Arabia into Persia, Turkey, Continental Europe, England, and America, it became immediately in vogue. In spite of many prohibitive edicts by political and religious authorities because the coffee-houses were popular to the disadvantage of the attendance at religious services or because they were accused of being "Seminaries of Sedition," the con-

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, April 16, 1927.

sumption of coffee has steadily increased. The present annual world consumption is between 2½ and 3 billion pounds. The United States consumes over one-half of the world production. Our per capita consumption of over 12 pounds annually is exceeded only by Sweden, Denmark, and Norway. The average family in New York City uses 55 pounds a year. The people of New York City buy over 70½ million pounds every twelve months and pay over $30,000,000 for the Arabian coffee seeds (beans).

The botanist distinguishes 40 species of coffee (*Coffea*) as indigenous to Africa, India, and adjacent areas, but the plant is naturally foreign to America. Only three species, Arabian or Common Coffee (*Coffea arabica*), Liberian Coffee (*C. liberica*), and Robusta Coffee (*C. robusta*), of the nineteen economic species are cultivated in sufficient amounts to enter the world market and become a factor in international trade. The coffee plant is a small evergreen tree bearing fragrant white flowers which produce crimson cherry-like fruits containing two seeds (coffee beans) with their flat sides together and embedded in a sticky, white, sweet, and edible pulp. Each seed is enclosed in a parchment envelop. In 1717, the ancestor of American coffee trees was planted in the Martinique colony, French W. I., by M. Desclieux, a naval Lieutenant under the orders of Louis XIV. He propagated a single seedling plant which had survived the journey from France. Coffee-growing spread through the West Indies and to parts of South America, Central America, and Mexico. The Dutch introduced coffee into Java in 1690. In 1735, the first Brazilian plantation was established and today Brazil has 1,769,000,000 full-bearing coffee trees and leads the world as a coffee-producing country. Africa was the source of coffee beans until 1800 but now only 2 per cent. of the world's coffee supply is grown there. The United States receives 80 per cent. of its coffee beans from Brazil. Colombia, second as a world source, supplies a large per cent. of our mild grades.

Only 5 per cent. of the vast, suitable tablelands of Brazil have yet been utilized. At sea-level, as it is grown in most countries, coffee plants develop flowers, young fruits, and mature fruits at the same time, which results in a very attractive tree but necessitates " finger " picking, fruit by fruit, which is slow and laborious.

On the Brazilian tablelands, there are distinct seasons for the flowering and picking which is accomplished by stripping and is easier and less expensive. Harvesting begins in May and lasts well into August and September. This is the dry season, which is favorable to the gathering of the fruits and for the drying and transporting of the gathered crop. In picking coffee, the entire population—men, women, and children—take part. The branches are pulled down and held at the outer end with the left hand while the right hand strips off the berries from the base to the tip. An experienced laborer can gather enough coffee berries in a day to make 50 pounds of dried coffee.

The maleberry or peaberry coffee is a rounded bean which develops with the abortion of the other seed. These fruits containing only one rounded bean usually occur at the tips of the branches. Their composition is more concentrated, they are stronger and command a higher price. In Brazil, they are called "Mocha." It is the same bean which the Americans call "Caracollilo." In the United States, the term "Mocha" properly refers only to the true Arabian coffee from Aden, Arabia, and very little of it is imported annually. Mocha is actually the name of an exporting town surrounded by deserts. No coffee is grown in the immediate vicinity although it is shipped through Mocha. The color of the coffee bean depends upon the region in which it is produced, the weather during its growth, and the age of the harvested bean. After several years' storage, the beans assume the color of old ivory. With age, the beans lose weight and also the bitter flavor of the freshly picked seeds, so that they gain in value. Immediately after picking, the fruits are pulped and the resulting parchment-covered seeds are subjected to drying, hulling, cleaning, and sizing. The beans are then packed in bags and stored in a dry, well-ventilated, non-odorous warehouse to await shipping and roasting.

Adulteration of coffee beans and ground coffee has long been practiced. During the last 75 years, the seeds, roots, and other parts of many plants have been utilized for this purpose. Adulterants have included artificial beans, sawdust, bread, and even baked ox-liver. Adulteration and sophistication is readily detected by simple physical, chemical, and microscopic tests. The products of 38 botanical families have played a part in coffee adulteration.

There is still much adulteration and substitution in Europe. The recent Dutch law states that the term "coffee" includes pure chicory, acorns, figs, malt, and other cereals, and various coffee substitutes—*all* are coffee. The American market is not seriously concerned with such practices. The substitutes consist chiefly of roasted grains and the beverages prepared from them are nothing but weak broths. All coffee substitutes, including the decaffeinated and defibrinated, instantaneous coffees, are inferior to 100 per cent. coffee—if for no other quality, because they partially or completely lack the pleasing aroma. The close interrelationship between the human senses of taste and smell makes the presence of the aroma a very important factor in the enjoyment of the beverage. A few individuals, perhaps 3 per cent. to 5 per cent. of the adult population, can not wisely partake of coffee because of their peculiar inability to digest or assimilate the constituents of the beverage. Many people have similar idiosyncracies with regard to such foods as strawberries, clams, spinach, and tomatoes, as is shown by the skin eruptions which follow the eating of these foods.

My experimental data obtained from observations on animals and man since 1920 with regard to the effect of caffeine and of the coffee beverage on man clearly indicate that the properly prepared coffee beverage is a great blessing to the vast majority (95 per cent.) of humanity. The small doses of one and one-half grains of caffeine, which is the average amount in the ordinary cup of coffee, are mildly stimulating to the brain and body. This results in better coördination for continued mental and physical work and gives relief from fatigue and hunger. There is no apparent after-effect. The activity of the body is increased rapidly and the slow return to normal is not accompanied by any subnormal or recuperation period. Coffee is the most beneficial and harmless of any equally stimulating beverage employed by man.

RALPH H. CHENEY.

WISTERIA

Wisteria! Of all our familiar flowering vines there is none more beautiful than the Wisteria. An arbor, a trellis, a porch is transformed into a glorious bower of cerulean festoons when the graceful pendants of pale blue racemes hang down amid the delicate foliage of the vine. There is beauty in the name itself and its very utterance recalls to mind scenes of oriental charm. It is a synonym of all that is delightful to behold.

So charming a plant is deserving of not only admiration but intimate acquaintance. It was Thomas Nuttall, the American naturalist of the early part of the nineteenth century, who named this genus for Caspar Wistar, Professor of Anatomy in the University of Pennsylvania, at the beginning of the century. Though other names have been assigned to the plant by various authors it will be under this very familiar and pleasing title that we shall here consider the plant. It is well, however, merely to cite these other names lest their identity be obscure in chance finding. Constantino Samuel Rafinesque-Schmaltz, who was a contemporary of Nuttall and Professor of Natural History at Transylvania University in Louisville, Kentucky, at one time named this plant Kraunhia and at another time Diplonix. An earlier French writer applied the name Bradleia.

There are six species of Wisteria known, two of which are recognized as native to the eastern United States and four are indigenous in eastern Asia. There are, in addition, several varieties of these species.

The two native Wisterias are known by their botanical names as *W. macrostachys* and *W. frutescens.* Both are somewhat southern plants, usually frequenting low, swampy lands. *Wisteria frutescens* occurs from Virginia and Florida to Texas and *W. macrostachys* from Missouri to Tennessee and Texas.

They differ from one another in the length of their racemes or flower clusters. *Wisteria frutescens* has the shorter and consequently denser raceme, 4 to 5 inches or less in length while those of the Long-clustered Wisteria, *W. macrostachys,* may be a foot or more long. I have never seen these growing in their natural haunts but it is not difficult to imagine what exquisiteness their light blue or purplish densely flowered blossoms must give to the

thickets. And because of their rare beauty they have not been allowed to bloom unsung in the southern swamplands but have been transplanted and cultivated about homes in America since the early nineteenth century and possibly earlier.

Two varieties of *Wisteria frutescens* have been recognized. The one known as *W. frutescens* var. *alba,* or sometimes var. *nivea,* has white flowers, and var. *magnifica,* whose racemes may be 6 to 8 inches long with 50 to 60 flowers an inch across, is lilac-colored with a yellow spot. It blooms earlier than the type. A contemporary author has named a variety of the Long-clustered Wisteria, *W. macrostachys* var. *albo-lilacina,* because of its lighter colored lilac-pink flowers.

FIGURE 2. *Wisteria sinensis,* with Iris, etc., in the garden of Mrs. Wheeler H. Peckham, New Rochelle, New York.

Now we may consider the four exotic species. *Wisteria sinensis* (sometimes spelled *chinensis*) is the Chinese Wisteria. True to its name, it is endemic in China and is much cultivated in gardens at Shanghai and other wealth and cultural centers of eastern China. It has been introduced and cultivated in Japan as well as in America. A white form, *W. sinensis* var. *alba,* is equally well known.

Wisteria floribunda is the Japanese Wisteria, the one most frequently seen blooming so gloriously about homes in America. It is often advertised as *W. sinensis,* from which it differs, however, in a greater number of leaflets, 7 to 9 pairs. *W. sinensis* has usually less than 7 pairs. Moreover, the Chinese Wisteria has much larger flowers, blooms about two weeks earlier and is not so hardy a plant as *W. floribunda.*

Wisteria floribunda is endemic to Japan, where it grows in woods and by lakes and streams. It is used, together with its cultivated varieties, in temple grounds, parks and gardens. Its young leaves are densely hairy but lose this feature at maturity. There are possibly five varieties of this species and it will suffice to enumerate them. Var. *alba* has white fragrant flowers and is cultivated in Japan; var. *rosea* has rose-colored or pale-pink flowers with wings and tip of keel purple; var. *variegata* has variegated foliage; var. *violaceo-plena* has violet double flowers and is occasionally cultivated in Japan; var. *macrobotrys* has exceptionally long racemes, sometimes 2 or 3 feet in length.

Wisteria venusta, the Silky Wisteria, is the most distinct of the four Wisterias of eastern Asia. Its persistent velvety pubescence on both sides of the leaves, its short very broad racemes, its long, stout, nearly horizontally spreading flower-stalks, and its very large flowers cause this distinctiveness. The flowers are white and var. *plena* is the only double-flowered white Wisteria known.

All these exotic species differ from the two native ones in the fact that their pods are velvety while those of the native species are smooth.

There is one more species generally described with the Wisterias, though it does not properly belong with that genus. It is *Wisteria japonica,* known also as *Millettia japonica.* It very much resembles the true Wisterias and has white flowers but differs from them in the fact that the standard of the papilionaceous flowers lacks auricles at the base. This plant occurs in Japan and Korea and though it blooms and even fruits on Long Island it is not hardy in the north and little known in this country.

There is another species, *Millettia megasperma,* which is known as the "evergreen wisteria." It is a woody climber imported from Australia into California. The flowers are purple, in racemes 4 to 6 inches long.

Most of the true Wisterias are well established in America and offered by dealers, frequently under different names. The Long-clustered Wisteria designated by dealers as *Wisteria multijuga* is probably the Japanese *W. floribunda.* The native *Wisteria frutescens* is offered as *W. magnifica* and popularly named American Purple Wisteria.

One attractive feature of the Wisterias is that they bloom not only in May but periodically during the summer with a smaller crop of flowers as late as August and September. The spring crop is borne on spurs while the later blossoms appear on terminal shoots of the season's growth. Though the Wisteria of itself forms graceful plants of contorted and upright growth it lends itself readily to training. Either to run the length of a decadent tree and garb it in delicate drapery or creep beneath the long eaves of the cottage, Wisteria is equally well suited. Though adapted to a variety of soils it is only in deep and rich earth where the long and few roots may penetrate deeply that Wisteria blooms at its best.

EDMUND H. FULLING.

SOME GEOLOGICAL FEATURES OF THE NEW YORK BOTANICAL GARDEN[1]

The lecture was limited to more detailed descriptions and explanations of certain special features in connection with the phenomena of erosion, transportation, and deposition of material through the agency of water and of ice.

In geological field work, we observe certain natural features which we recognize as effects that were produced by natural causes, and we endeavor to infer, by reasoning *a posteriori,* what the causes must have been that produced the effect.

Suppose, for example, we consider the present course of the Bronx River in this vicinity. Down to a certain point just below the Williamsbridge station of the railroad, it hugs the west side of the valley, where the underlying bed rock is the eroded dolomitic

[1] Abstract of a lecture given in the Central Display House of Conservatory Range No. 2 on Saturday afternoon, February 26, 1927.

limestone outcrop that determined its original channel, and which continues in a southwesterly direction almost in a straight line. The river, however, instead of following the old channel, turns across the valley to the east side, follows the eastern escarpment for a short distance and thence continues by way of the gorge, eroded through a broad ledge of hard crystalline schist that formerly constituted an irregular reef or rocky barrier across the valley from its eastern side to the old limestone channel of the river along the western side. The northern escarpment of this ledge, just to the north of the Museum Building, is well defined by the upper and lower lakes at its base.

The interesting problem to consider is why the river abandoned its old channel in the relatively soft and easily eroded limestone and carved out a new channel through the hard-rock barrier of schist? It is evident, from the presence of "pot-holes" in the rock, at various levels on the surface of the ledge, that at one period in the history of the river it extended entirely across the valley and flowed over all except the highest parts of the ledge, through at least two well-defined depressions—one represented by the swale now occupied by the Herbaceous Plantation, the other along the site of the present river gorge—as well as through the main channel along the western side. The abandonment of this channel was apparently caused by some obstruction, probably ice, which remained for a period of time sufficient to enable the river to erode, to a lower level, one of the channels through the rock ledge; and when the flow of the river became reduced to normal this channel remained as the only active one. The waters were diverted to it alone and eventually the gorge as we know it today was developed. Pot-holes at diffierent levels in the rock that forms the western side of the gorge attest the gradual erosion of the rock, in what was originally a broad depression in the ledge, and its subsequent evolution into the existing narrow, steep-sided gorge.

A pot-hole has its beginning in an irregularity in the rock bed of a rapidly flowing stream. Gravel, or perhaps a single rock-fragment finds lodgment there. If conditions are favorable—if the material is free to move and the current of the stream is sufficiently strong to swirl it around the original irregularity becomes deeper and more or less circular in shape, due to the abrasive

action of the contents, and a pot-hole results. A pot-hole, therefore, no matter where it may be found, represents indisputable evidence that the rock in which it occurs was, at some time, either a part of the bed of a rapidly flowing stream or the base of a waterfall.

Excellent examples of shallow pot-holes may be seen in the rock out-crop along the west border of the Herbaceous Grounds and deeper ones in the northeast section of the Hemlock Grove in the vicinity of the Boulder Bridge; and an example of channel erosion in the rock may be seen on the summit of the out-crop on which the Rock Garden is located.

The flood plain on which the Fruticetum is located is also a mute witness of the former valley wide extent of the river waters. This plain is composed of beds of sand, gravel, and cobbles that were evidently deposited in the slack water that resulted from the checking of the velocity of the river current by the transverse barrier of the rock ledge. The transporting power of a stream varies as the sixth power of its velocity. Thus, if the velocity is doubled, the transporting power is increased by 2^6 (= 64-fold); but, on the other hand, if the velocity is checked the transporting power is checked in the same ratio, and deposition at once ensues, and hence the extensive deposits of water-transported material that form the flood plain of the valley north of the barrier ledge that crosses it.

Certain glacial phenomena are also striking features in many places within the Garden area; but these have been described on several other occasions and only brief reference to them now would seem to be necessary. The Continental ice sheet of the Glacial Epoch of the Quaternary Period left its records here, as elsewhere, in the form of transported boulders, rounded and striated rock outcrops, and accumulations of rock débris—unassorted deposits of clay, sand, gravel, and boulders, technically known as "till." Certain of the boulders, especially those that are isolated and perched on bare rock ledges, or close to the edge of some cliff or rocky declivity, are prominent natural features of the Garden; and in places the ice-scored rock surfaces may be observed.

Undisturbed deposits of till are not extensively represented anywhere within the boundaries of the Garden. There is a limited amount on the summit of the high elevation in the vicinity of

the Allerton Avenue Gateway, but throughout the lower levels all except the larger constituents of the till were swept away by the flood waters from the melting ice front of the glacier in its retreat.

The lecture was illustrated by explanatory charts and diagrams, and by specimens representing typical water- and ice-transported material. Reference was also made, for those who might wish further information, to an article by the late Professor J. F. Kemp, on "The Glacial or Post-Glacial Diversion of the Bronx River from its Old Channel," in Trans. New York Acad. Sci., vol. 16, January 22, 1897; and to two illustrated articles by the lecturer: "Pot-Holes in The New York Botanical Garden," published in the JOURNAL of the Garden for September, 1913, and "Records of Glaciation in The New York Botanical Garden," in the JOURNAL for December, 1926.

ARTHUR HOLLICK.

THE FRANCIS LYNDE STETSON FUND

An unconditional bequest of $25,000 by Mr. Francis Lynde Stetson was received from the executors of his will in 1921. At the meeting of the Board of Managers held April 20, 1922, the following resolution was adopted:

Resolved, That the bequest of $25,000, received from the estate of the late Mr. Francis Lynde Stetson, be and hereby is designated the Francis Lynde Stetson Fund, and that its income be applied to such purposes as may be voted by the Board of Managers from time to time.

Mr. Stetson was a member of the Board of Managers from 1908 until his death on December 5, 1920, and a vice-president from 1914.

This fund yields an annual income of about $1,200 and this has been applied since 1922 toward the expenses of public lectures at the Garden; these lectures are delivered on Saturday afternoons, using the Museum lecture hall in spring, summer, and autumn, and the Central Display Greenhouse of Conservatory Range 2 in winter; they cover a wide range of botanical and horticultural topics.

N. L. BRITTON.

NOTES, NEWS, AND COMMENT

Dr. Bruce Fink, Professor of Botany in Miami University, Oxford, Ohio, since 1906, died suddenly on July 10, in his sixty-sixth year. Dr. Fink, who was at the time of his lamented death the best-known American authority on the lichens, was a frequent visitor at The New York Botanical Garden. He determined the lichens collected on several of the Garden's more recent expeditions, notably those from Porto Rico.

Mr. Thomas A. Edison devoted five days in July (11–15) to reading books and pamphlets on rubber-producing plants in the library of The New York Botanical Garden. He was accompanied by an assistant, Mr. Barukh Jonas, who made abstracts of papers published in various foreign languages. On June 16, Mr. Edison, then accompanied also by his assistant and confidential secretary, Mr. William H. Meadowcroft, visited the Garden and examined a considerable number of living specimens of rubber-yielding plants.

Professor E. D. Merrill, Dean of the College of Agriculture of the University of California and formerly Director of the Philippine Bureau of Science, has been appointed Director of the new California Botanic Garden at Los Angeles. Beginning June 1, 1927, Professor Merrill will, for the present, devote four fifths of his time to the development of the new institution. A group of public-spirited citizens of California have pooled their interests in 3200 acres of land, lying within the city limits of Los Angeles and valued at between $20,000,000 and $30,000,000. The entire property has been turned over to a trust company, acting for the Garden Foundation Incorporated, a non-profit, non-stock corporation. Approximately 800 acres will form the garden proper and this area will be unalienable. The remainder of the land will be sold, all profits going to form the endowment of the California Botanic Garden.

Following one of the provisions of the act of the last Congress establishing a National Arboretum at Washington, Secretary of Agriculture Jardine has announced the membership of the Ad-

visory Council, which is to plan and develop the arboretum. The members are Frederic A. Delano, Washington, D. C., member of the Board of Regents of the Smithsonian Institution, Chairman; L. H. Bailey, Ithaca, New York, president of the Botanical Society of America; Henry S. Graves, New Haven, Conn., dean of the School of Forestry, Yale University; Harlan P Kelsey, Salem, Mass., former president of the American Association of Nurserymen; John C. Merriam, president of the Carnegie Institution of Washington; Mrs. Frank B. Noyes, Washington, D. C., chairman of the District of Columbia committee of the Garden Club of America; Frederick Law Olmsted, Brookline, Mass., former president of the American Society of Landscape Architects; Mrs. Harold I. Pratt, Glen Cove, L. I., secretary of the Garden Club of America; Robert Pyle, West Grove, Pa., director of the Society of American Florists and Ornamental Horticulturists and a former president of the American Rose Society.

At the meeting of the Directors of the American Iris Society held in New York on December 11th, the medal of the Garden Club of America, which had been offered to the society for the best seedling introduced in 1923, was officially awarded to Morning Splendor, a variety raised by J. Marion Shull, of Washington, D. C., and no other awards were made for 1923 seedlings or for 1924 seedlings. An appropriation was voted to The New York Botanical Garden for the purpose of instituting research work in Iris breeding between species, this work to be carried out by students working under the direction of Dr. A. B. Stout. An appropriation was also made to the Brooklyn Botanic Garden to further the work in investigation of Japanese Iris begun some years ago by Dr. George M. Reed. It was announced that a new Iris Test Garden was being started at the Missouri Botanical Garden, where already about 900 varieties have been assembled. It is expected that special work on color classification will be undertaken there in the future. Announcement was also made of the special study of Dwarf Iris to be begun this year at the Cornell Test Garden under the direction of Dr. A. H. Wright. The lantern slides owned by the society are now in the custody of Mrs. Silas B. Waters, Edgecliff Point, Walnut Hill, Cincinnati, Ohio, and they may be rented by garden clubs and other horticultural organizations.

Meteorology for June. The total precipitation for the month was 3.42 inches. The maximum temperatures recorded at the Garden for each week were 83° on the 5th, *92° on the 10th,* 81° on the 13th, and 86° on the 28th. The minimum temperatures were *45° on the 2nd,* 50° on the 8th, *45° on the 16th,* and 55° on the 28th.

ACCESSIONS

LIBRARY ACCESSIONS, JANUARY 1–APRIL 30, 1927

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 35,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific, and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated undor the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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REPORT OF THE KILLIP–SMITH BOTANICAL EXPEDITION TO COLOMBIA, 1926–1927[1]

The trip which Mr. Albert C. Smith and I have just made to Colombia followed very closely the plans outlined to the directors of the coöperating institutions a year ago. These called for visiting the Jacquin and Humboldt[2] localities in the Cartagena area

[1] A preliminary report to the heads of the coöperating institutions.

[2] Nikolaus Joseph von Jacquin, Austrian baron of Dutch birth, was born 16 February, 1727, at Leyden, and died at Vienna, 26 October, 1817, at the age of ninety. His earlier education was at Antwerp and Louvain; he began his medical studies at Leyden, continued them at Paris, and completed them at Vienna. Meanwhile he had decided to devote his life to botanical science. In 1754 he was commissioned by the Austrian emperor to visit the American tropics, to collect plants for introduction to the royal gardens. He took with him as an assistant Richard van der Schot, who long afterward became director of the gardens at Schönbrunn. They sailed from Leghorn 1 January, 1755, and landed at Martinique 28 June; Schot returned to Europe in February, 1756, but this island remained Jacquin's headquarters for a year and a half, although meanwhile he had visited many of the other islands of the Lesser Antilles, northward as far as St. Martin, and southward as far as Grenada. In 1757 he spent considerable time on the island of Curaçao, and it was probably during that year that he made his memorable visit to the mainland at Cartagena, where he discovered so many interesting plants new to science. He was obliged to confine his collecting to the immediate vicinity of the city, and the several neighboring islands. The latter half of his stay in America was spent in Cuba, Hispaniola, and Jamaica; he arrived once more in Vienna in July, 1759. During the four years Jacquin had drawn, from fresh specimens, hundreds of the plants collected, and had made at least eight shipments of living plants. The rest of his life was devoted in large measure to the study of these collections; among his 22 folio volumes there are some accounted among the most valued treasures of

and for collecting in the Eastern Cordillera in the vicinity of Bucaramanga, Pamplona, and Ocaña, a region little known botanically. Three weeks were spent about Cartagena and Turbaco, two and a half months in the general vicinity of Bucaramanga, and one month along the Colombian-Venezuelan border, east of Pamplona. Because of lack of time and deterioration of collecting equip-

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the great botanical libraries of the world. His herbarium went to England, and is now at the British Museum of Natural History.

Friedrich Heinrich Alexander von Humboldt, German baron, was born 14 September, 1769, at Berlin, and died there, 6 May, 1859, in his ninetieth year. Aimé Jacques Alexandre Bonpland (né Goujaud) was born 23 August, 1773, at La Rochelle, France, and died at Restauracion, Uruguay, 11 March, 1858, in his eighty-fifth year. Both were men of wide culture, and were authors of important scientific books and papers, but it is their joint work of exploration in tropical America in the years 1799 to 1804 that has immortalized their names in the history of science, and especially of botany. Sailing from La Coruña, Spain, 5 June, 1799, and spending ten days in the Canary Islands, they sighted Tobago 13 July and arrived at Cumana, on the coast of Venezuela, 16 July. Keeping near the coast as far as La Guayra, they visited Caracas, Cura, and Valencia, again reaching the coast at Puerto Cabello. From this point they struck into the interior, returning to Cura, and going thence as nearly due south as the ruggedness of the country would permit, to San Fernando, on the banks of the Apure, where they arrived 27 March, 1800. Taking a boat down the Apure and up the Orinoco, it was at the junction of the Meta that they first sighted territory now belonging to the republic of Colombia, and they skirted its eastern boundary for more than two hundred miles, up the Orinoco and Atabapo and down the Guainia, then regarded as the Rio Negro, of which it is now considered a tributary. Turning back from San Carlos, 10 May, they went up the Cassiquiare and down the Orinoco all the way to Angostura, thence overland to Barcelona; quitting the South American mainland forever, as they supposed, they sailed for Havana, 24 November, 1800. After a few months in Cuba, however, they returned to South America, landing at the mouth of the Sinu, on the northern coast of Colombia, 25 March, 1801, and arriving at Cartagena five days later. From this point they traversed the heart of Colombia from north to south, up the Magdalena and across the Cordilleras, arriving in Quito, 6 January, 1802. From Ecuador they went to Peru, spent about a year in Mexico, and after a brief visit in the United States sailed for France, landing at Bordeaux 3 August, 1804. The sumptuous volumes devoted to the reports of their voyage are among the classics of natural science. The plants collected by them are in the herbarium of the Paris museum, and in that of Willdenow at the Berlin botanic garden.—JOHN HENDLEY BARNHART.

ment, it proved impracticable to visit both Ocaña and the frontier region; the latter was chosen because of its accessibility to Pamplona and because of the probability of its flora being more unusual. Other localities at which collections were made were Calamar and Puerto Wilches, on the Magdalena River; Cúcuta; Maracaibo, Venezuela; Curaçao; Puerto Colombia, and Santa Marta. About five months were spent in the field, the time given to the various general localities being as follows:

Oct. 20. Sailed from New York.
Oct. 29–Nov. 22. Cartagena–Turbaco.
Nov. 23–Dec. 4. Magdalena Valley.
Dec. 5–Feb. 18. Dept. Santander, Bucaramanga as base.
Feb. 19–March 24. Dept. Norte de Santander, Pamplona as base.
March 25–March 27. En route Cúcuta to Curaçao via Maracaibo.
March 28–31. Curaçao.
April 2–5. Puerto Colombia and Santa Marta.
April 15. Arrived at New York.

Account of Trip

With Cartagena as a basis collections were made on Manga and Tierrabomba islands, at Boca Grande, and on La Popa, a hill near the city, all Jacquin localities. Cartagena is a rapidly changing city, due to its growing importance as a port of entry and to the fact that it is the terminus for the pipe line bringing oil from the fields in the interior to the coast. Manga Island is now the principal residential suburb of the city, and only the southern end, perhaps 15 per cent. of the whole island, at all approaches a wild state. Tierrabomba and part of Baru Islands have been taken over by oil companies for use as ports. Little work has as yet been done to change the character of these islands, and it would seem that if further collecting is to be done here, it should be undertaken in the very near future. In such case, however, the project should be taken up directly with the Andian Corporation and the Tropical Oil Company, in New York, as they are in a position to render valuable assistance.

Turbaco, 15 miles east of Cartagena, is at the crest of a range of low hills, at an altitude of about 200 meters. Humboldt spent

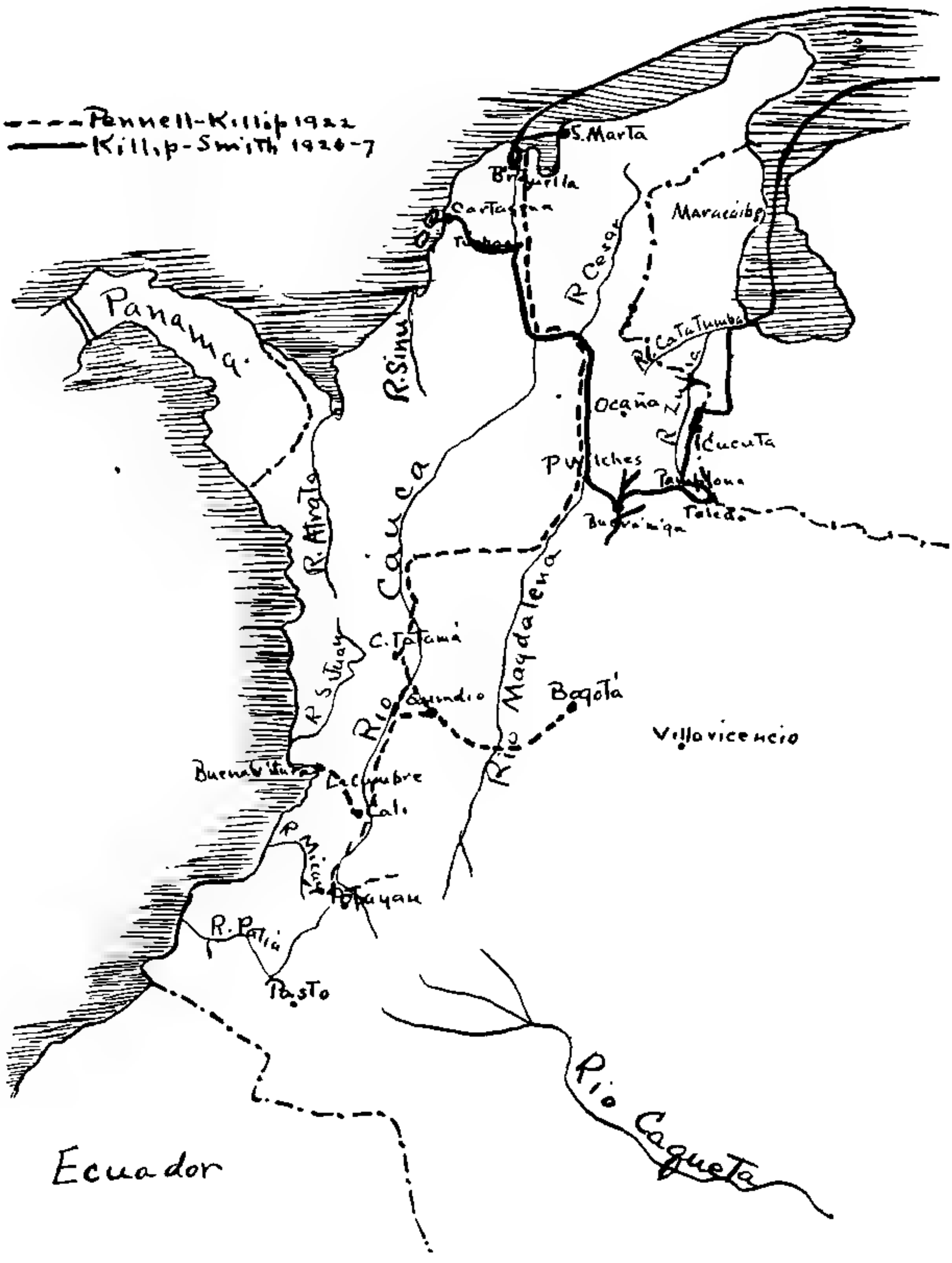

FIGURE 1. A sketch map, showing routes of the Pennell–Killip Expedition of 1922 and the Killip–Smith Expedition of 1926–27.

The Rusby–Pennell Expedition of 1917 explored the Rio Sinu, portions of the Quindio mountains, and the regions about Bogotá and Villavicencio.

ten days here before ascending the Magdalena River on his trip to Quito, and it is the type locality for several species. Though a considerable part of the land is at present under cultivation, dense woods still remain to the westward, near Torrecilla, and nearly impenetrable thickets cover much area. One day was spent at Coloncito, an hacienda north of the town which would serve as an excellent headquarters should further work be carried on here Particularly interesting were the mud volcanoes, about nine miles from Turbaco, where we made a fairly large collection. Arjona and Soplaviento, two towns between Turbaco and the Magdalena, were also visited. At Soplaviento Mr. Smith obtained many water plants along the Dique, the canal connecting the river with Cartagena.

A few plants were collected at Calamar, where the steamer was boarded for the trip up the Magdalena. As it was an oil-burning express boat, few stops were made, and the long delays to take on wood, which have given botanists an opportunity to make hurried collections, as well as to contract malaria, were avoided.

We spent a week at Puerto Wilches, about halfway between the coast and Bogotá, before taking the railroad on the trip into the interior. Typical tropical jungles surround the town, well flooded near the river at the time of our visit at the end of the rainy season. This jungle extends eastward nearly to the base of the mountains, portions of it being reached by us at various stations along the railroad.

On December 3 we left the river for the interior, proceeding by rail to Provincia, near the foot of the mountains, and then by mule to Bucaramanga. Little collecting was done on this two days' trip, though two localities were noted en route, El Tambor and Las Cruces, which would serve as excellent bases for further work. Had we had opportunity we should have returned here, though I do not believe the vegetation was markedly different from that later found on the Mesa de los Santos.

Bucaramanga proved an ideal center of operations, and from December 5 to February 16 this was our main headquarters. Situated on a plateau which dropped abruptly to deep valleys on three sides, the immediate vicinity was not especially interesting botanically; but areas to the south, east, and north, from two to four days of mule travel distant, were extremely rich. The Mesa

de los Santos, a broad plateau about 1,500 meters altitude, was first visited. Although there was no range of altitude here, the presence of dense woods, sandy fields, marshes, and rocky cliffs within a few miles of our inn resulted in a wide diversity of plant groups.

Our second trip from Bucaramanga took us to the isolated region to the eastward about Las Vegas. With our base established at a ranch at 2,600 meters, in the midst of a rich vegetation, a two days' trip was made to the Paramo de las Vegas, the highest

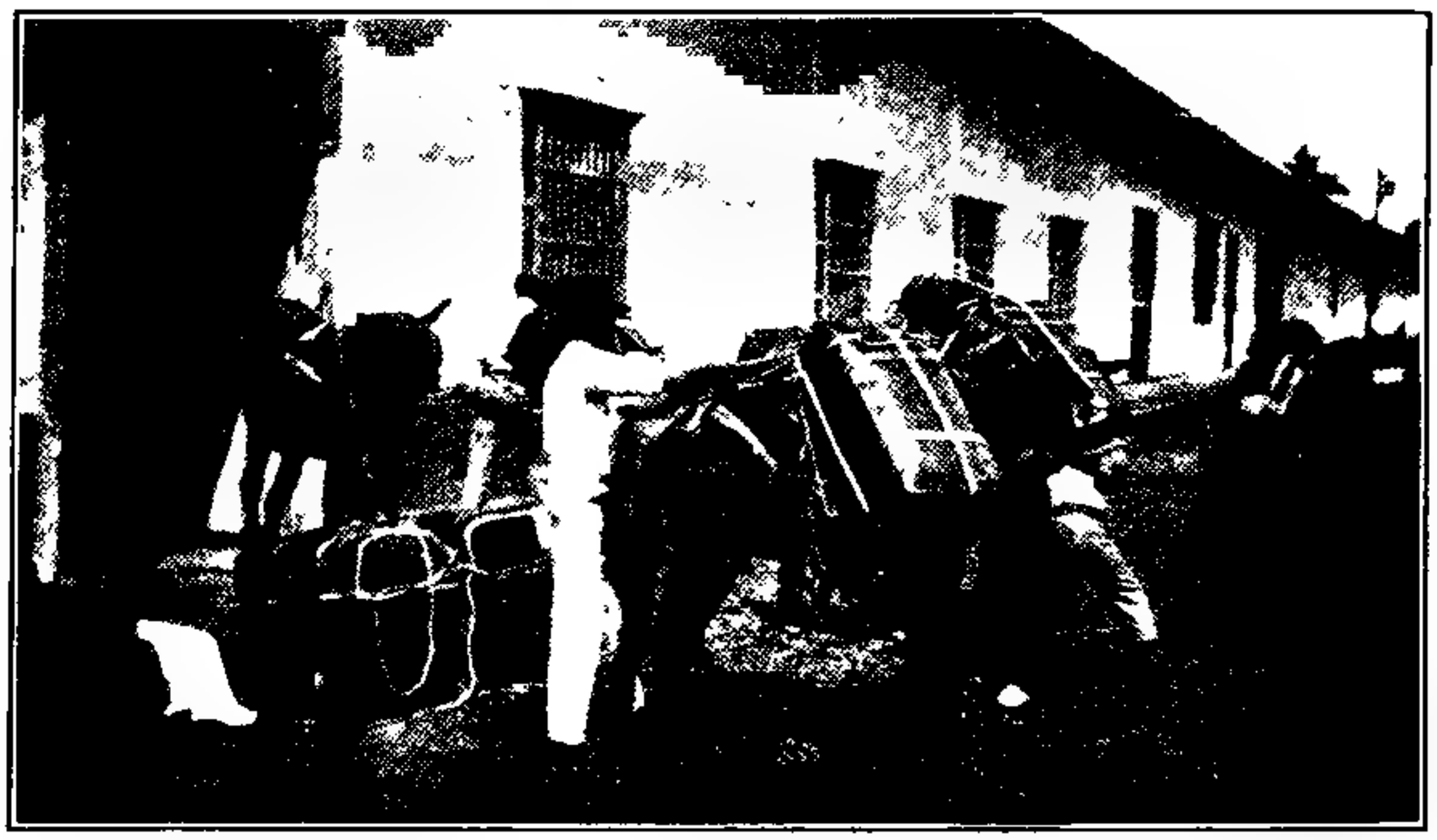

FIGURE 2. Loading mules at Bucaramanga.

point of which was 3,800 meters. As this was our first collecting in the Eastern Cordillera through a large range of altitude, we found the flora between the ranch and the paramo especially interesting, consisting, as it did, of the wet forests of the subtropical zone, the scrubby growth of the temperate, and the low, chiefly herbaceous, vegetation of the paramo.

One of the main purposes of the expedition was to revisit certain Funck and Schlim and Linden[3] localities. Almost the only

[3] Jean Jules Linden was born 3 February, 1817, in the city of Luxemburg, and died at Brussels, 12 January, 1898. In later life he was one of the most famous of Belgian horticulturists, but before he was thirty years old he had made three collecting trips to America under the auspices of the Belgian government. The first, 1835–37 (he was only 20 upon his return home) was to Brazil; the second, 1837–41, to Cuba,

Mexico, and Central America. On both of these expeditions he was accompanied by Nicolas Funck (1816–1896) as artist, and Auguste Boniface Ghiesbreght (1810–1893) as zoologist; both Funck and Ghiesbreght afterward became well known as plant-collectors. Linden's third trip was devoted almost exclusively to Venezuela and Colombia; this time he was accompanied by his half-brother, Louis Joseph Schlim. Arriving at La Guayra, 27 December, 1841, they spent the first few months in the vicinity of Caracas, starting for the interior 5 May. Their route lay through Valencia, Puerto Cabello, Barquisimeto, and Mérida, entering Colombia at San José de Cúcuta, and continuing by way of Pamplona, Socorro, Velez, and Tunja to Bogotá, where they arrived at the end of October, 1842. Here they spent two months, and then descended into the valley of the Magdalena, and fixed their headquarters at Ibagué, from which they extended their trips in every direction, once crossing by Quindio pass to Cartago, Buga, and the shore of the Pacific. From Ibagué they returned, through Ambalema and Honda, to Bogotá, whence they retraced their incoming steps as far as Mérida, Venezuela, and returned thence by a different route to Caracas, where they arrived 17 August, 1843. Leaving La Guayra 16 November, they spent six weeks at Puerto Cabello, and then went to Rio Hacha, on the coast of Colombia. Here their party was augmented by the governor and several other prominent citizens, and they spent several weeks exploring the Santa Marta mountains, climbing to the summit of the Nevado (4,800 meters). Sailing from Rio Hacha 4 March, 1844, they returned to Europe through Jamaica, Cuba, and the United States, arriving at home in February, 1845. After his ten years of fruitful exploration, Linden formed an establishment devoted primarily to the introduction of new plants, and sent collectors into all parts of the world; among these were Funck and Schlim, who collected for him in Colombia.

Nicolas Funck was born in 1816, in Luxemburg, and died there 10 August, 1896. He was with Linden on his journeys from 1835 to 1841, and went with him to La Guayra in 1841; they separated, however, at Caracas, in May, 1842. Funck spent most of the time for the next year in eastern Venezuela, but in 1843 he went to Santa Marta in Colombia, and collected in the neighboring mountains; it was probably his report that led Linden to visit them later in the same year. Upon Linden's return from Colombia to Caracas, they spent a few weeks together, and went together to Puerto Cabello, where Funck took ship for Hamburg. In October, 1845, Funck and Schlim started on a collecting trip in the interests of Linden's newly established horticultural concern. They first explored the vicinities of Caracas, Carabobo, Barquisimeto, Trujillo, Maracaibo, and Mérida, in Venezuela; then they visited the neighborhood of Chinácota and Pamplona in Colombia, near the Venezuelan border, and Funck took their collections by water from San José de Cúcuta to Maracaibo and thence to Europe, in 1847. Funck was afterward director of the zoological gardens at Brussels and

collecting done in the Eastern Cordillera north of the Bogotá area has been that of these European botanists about the middle of the last century. "La Baja, Province of Pamplona" and "Province of Ocaña" repeatedly appear in reports on these collections. The former Province of Pamplona is at present divided between the departments of Santander and Norte de Santander, the part west of the Divide being placed in the Department of Santander. The greater part of the Province of Ocaña is in the

FIGURE 3. Mud volcanoes of Turbaco.

Department of Norte de Santander. La Baja formerly was the principal town of what is to-day the general Bucaramanga region; it now consists of three or four houses and many ruins. Doubtless the town served as main headquarters for these botanists, their collections being made over a rather wide area.

Cologne, and in 1879 retired to his native place, where he spent the remainder of his life.

Louis Joseph Schlim, when he was left in Colombia by Funck, made La Baja, near Pamplona, his headquarters for more than a year, but all his collections in this region were lost by a shipwreck at the mouth of the Magdalena. He subsequently collected for a long time in the neighborhood of Ocaña, and, descending the Magdalena, spent several months in the Santa Marta mountains shortly before his return to Europe in August, 1852.—JOHN HENDLEY BARNHART.

The Suratá Valley, which was followed up from Bucaramanga to Suratá, our first objective in the La Baja region, was largely arid cactus country. North of Suratá densely wooded valleys gave us quite a different type of vegetation. Our main headquarters were established at California, about four miles south of La Baja. From this point Mr. Smith made a week's trip to the region about Vetas, visiting the paramos of Vetas, Santurbán, Mogorotoco, Rico, and Frailejonale. The following week I spent in the vicinity of La Baja, collecting on the paramos of Las

FIGURE 4. Edge of the Mesa de los Santos, looking towards mountains of Las Vegas.

Puentes, Las Coloradas, and Romeral. Following a different route back to Bucaramanga, Mr. Smith found an exceptionally rich vegetation in the neighborhood of Charta, obtaining here 425 collection numbers.

Our work in the general region of Bucaramanga having been completed, we had the choice of proceeding north to Ocaña (returning to the coast by the Magdalena River) or east to Pamplona and the Venezuelan border. Although there were many historic localities near Ocaña which we should have liked to visit, the wholly unexplored eastern part appealed to us more.

Mention should be made of the many courtesies extended to the expedition by officials of the Department of Santander and

the citizens of Bucaramanga. The governor assigned a school building to us for headquarters, assisted in procuring mules and

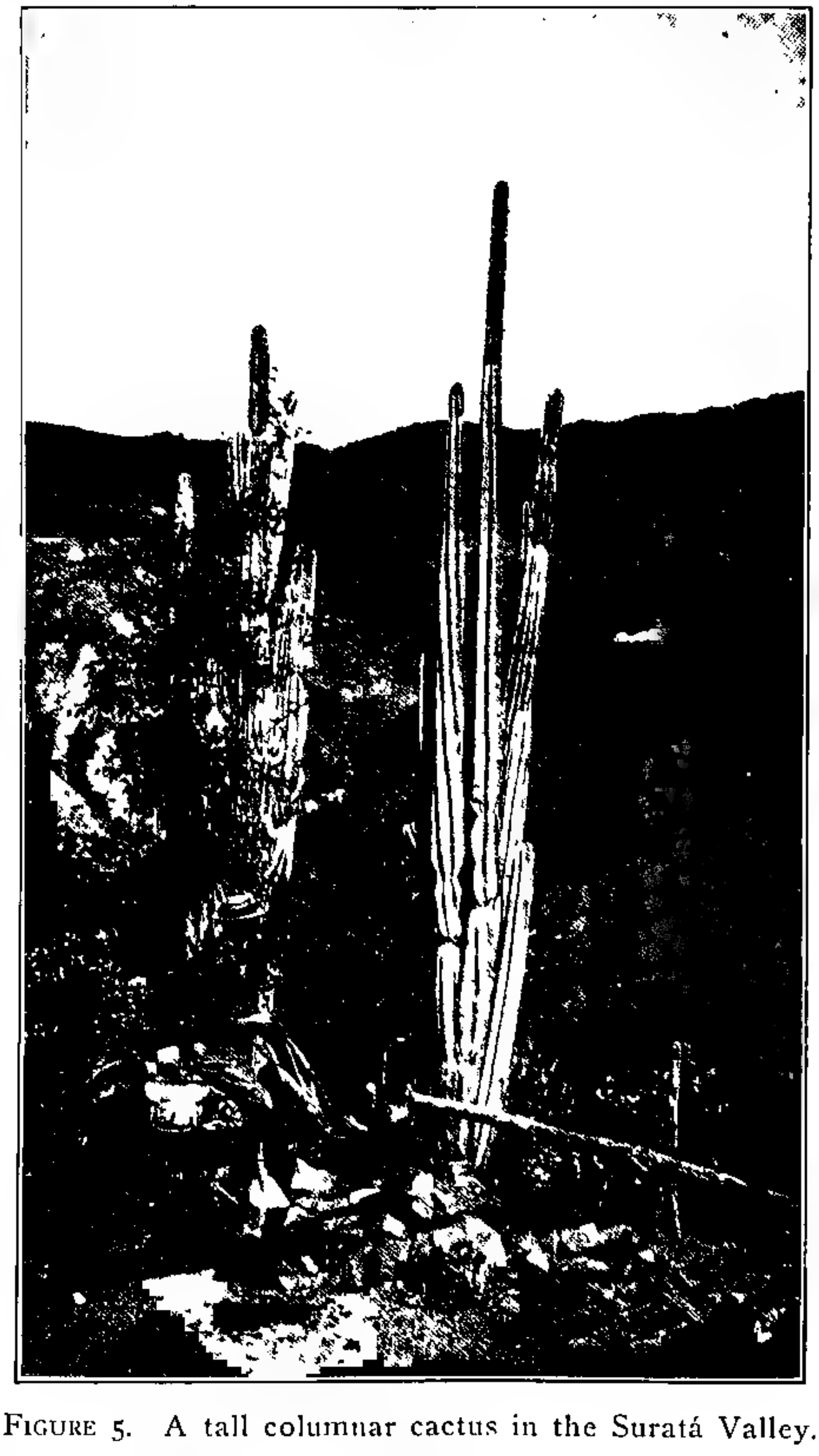

FIGURE 5. A tall columnar cactus in the Suratá Valley.

the services of a peon, placed prison gangs at our disposal to move luggage, and supplied us with letters of introduction to leading citizens of towns we were to visit. This valuable assistance repre-

sents only a part of the much appreciated help which we received throughout our trip. Letters which the Colombian Minister at Washington gave us were of inestimable value on many occasions. Representatives of the Singer Sewing Machine Company aided in the shipment of baggage, and generously acted as consignees for receiving at Cartagena and forwarding to New York boxes of dried specimens we sent from the interior.

The road from Bucaramanga eastward took us through alternately wooded and open valleys upward to the vast Paramo of Santurbán—the bleak region that so effectively cuts off the northeastern part of Colombia from the rest of the country across the paramo and down through Mutiscua, in a generally arid region, to Pamplona. The part of the paramo through which the trail passed apparently was too high—4,200 to 4,500 meters—for good collecting, but at El Roble and Tona, on the western side, and on the descent to Pamplona, many interesting things were discovered.

In the immediate vicinity of Pamplona nearly all the land had been cleared so we decided to move on to Toledo, nearly due eastward and only a few miles from the Venezuelan border. On the way there we passed through such interesting country that we frequently were obliged to alter our schedule and spend an extra day or two, with an Indian hut or an isolated posada as a base. After two weeks spent at Toledo we returned to Pamplona by way of the Paramo del Hatico.

As the time limit on our return tickets to New York had nearly expired, we went from Pamplona to Puerto Colombia by the quickest route, via Cúcuta, Maracaibo, and Curaçao, making small collections at Chinácota and La Esmeralda (between Pamplona and Cúcuta) and at Curaçao and Santa Marta.

I cannot conclude this review of the trip without expressing my very keen appreciation of the work done by Mr. Smith. A delightful traveling companion, full of enthusiasm, he acquired, in an amazingly short time, a most useful knowledge of tropical plant groups, collected unceasingly, and developed marked ability in the art of making herbarium specimens. I trust that he has further opportunity for botanical field work.

Collections

Approximately 7,150 numbers were collected, the principal groups being represented as follows:

Lower cryptogams	506	Ericaceae (part)	92
Ferns	780	Thibaudia (and allies)	65
Araceae	74	Convolvulaceae	77
Orchidaceae	286	Cordiae	66
Piperaceae	226	Solanaceae	204
Loranthaceae	57	Rubiaceae	216
Mimosaceae and Caesalpiniaceae	208	Centropogon (and allies)	89
Monnina	32	Eupatorieae	221
Passifloraceae	118	All other Compositae	475

Woody plants constitute about 36 per cent. of the collection.

The number collected at each of the principal localities follows:

Cartagena-Turbaco-Calamar	721
Puerto Wilches	219
Mesa de los Santos	528
Las Vegas	741
Vetas, California, Suratá, La Baja, and Charta	3,000
Bucaramanga to Pamplona	424
Toledo, and en route	975
Pamplona to Cúcuta	186
Curaçao	38
Puerto Colombia and Santa Marta	175

The distribution of the material among the coöperating institutions will follow in general the plan adopted by Dr. Pennell in the case of our 1922 collection. Mr. Smith recently spent ten days in Washington, giving valuable assistance in laying out sets. It is hoped that distribution to the coöperating institutions can be made by early fall.

Photographic Work

Photographs of about 100 woody plants were taken. Prints will be distributed with the corresponding specimens in the sets for The New York Botanical Garden, the Gray Herbarium, and the National Museum. These negatives will then be deposited at the Arnold Arboretum, in accordance with an understanding with Dr. Sargent. Numerous photographs of the general vegetation and of the life of the country were also taken; these will be kept

at the National Museum, and are, of course, available to the other institutions.

Finances

The attached statement shows the receipts and nature of the disbursements; an itemized statement is on file here. Changes in conditions in Colombia within the past five years resulted in a larger expenditure for various items than was anticipated at the time the project was first outlined. That we were able to accom-

Figure 6. Paramo of Santurbán, showing frailejones

plish the work substantially within the amount originally subscribed was largely due to the generosity of Mr. Cutter, President of the United Fruit Company, in giving the expedition free transportation to and from Colombia. The Academy of Natural Sciences, Philadelphia, lent the fibre-board valises which had proved so serviceable in 1922, permitting a saving of at least $75.00. Professor Stevens, of the University of Illinois, gave us his equipment for drying specimens. The National Museum supplied all the driers, corrugated boards, and paper used on the trip, as well as many other supplies incident to collecting. The National Museum is also having printed the necessary 40,000 labels (nearly 100 forms).

The difference between cost and selling prices of mules may seem abnormally high, but we were obliged to buy animals at

Bucaramanga, a city dependent wholly on mules for freight transportation, where prices have been greatly influenced by oil and coffee booms, and to sell them in Cúcuta, the junction point of three railroads and several automobile roads.

A small additional expense in connection with labeling and preparing the sets for distribution I believe is justifiable. In order that the specimens may be available for study as promptly as possible and may be clearly labeled, I propose to engage stenographic assistance. A memorandum of this will be sent the institutions at the time the sets are distributed.

FINANCIAL STATEMENT

Receipts

New York Botanical Garden	$1000.00	
Gray Herbarium, of Harvard University	600.00	
Arnold Arboretum, of Harvard University	600.00	
Mr. Oakes Ames	600.00	
Mr. Ellsworth P. Killip	150.00	
		$2950.00

Disbursements

Transportation (railroad, boat)		$ 358 34
Transportation (mule)		
Purchase of mules	$1070.00	
Credit, sale of mules	530.00	
	$ 540.00	
Purchase equipment	51.50	
Rent, extra mules	155.35	
Keep of mules	143.82	
		890.67
Baggage transfer		175.49
Board and lodging		653.68
Provisions		30.66
Kerosene		112.00
Equipment		
Cost	$ 215.63	
Credit sale	15.00	
		200.63
Cab and auto hire		40.30
Help		
Wages, regular peon	$ 105.00	
Keep, regular peon	56.84	
Extra men	63.69	
		225.53

Photographic work		
Supplies	$ 48.74	
Developing	17.10	
		65.84
Customs and immigration fees		36.80
Shipment specimens to coast	128.07	
Postage and miscellany	24.61	
		$2942.62
Balance		$ 7.38

Future Work in Colombia

The three expeditions which have gone into Colombia since the project for the botanical exploration of northern South America was undertaken ten years ago have brought back nearly 20,000 collection numbers. The Pacific slope has been visited at central and southern points; the Cauca Valley at northern, central, and southern; the Central Cordillera at central and southern; the Magdalena Valley at several points between Giradot and the coast; the Eastern Cordillera at northern and central points; the Atlantic coastal region at Cartagena, Barranquilla, and Santa Marta. More thorough work should be done in at least two of these general areas. In the short time that he was able to spend on the Cerro Tatamá, Dr. Pennell collected a large number of new species. Other isolated peaks in this northern part of the Western Andes should be visited. Similarly, the day and a half I spent in the Micay region, in the southern part of the Pacific slope, resulted in the collection of such a large number of new species and genera that without doubt this whole region, from the Micay river south to the Ecuador boundary and east to Pasto, would justify careful exploration.

To round out the work in Colombia so that a comprehensive flora of the country may be prepared, collections should be made in three additional areas:

1. The Santa Marta mountains above 6,000 feet altitude.

This is an isolated mountain mass with no apparent connection with the main cordilleras. There is every indication that its flora is a local one, and doubtless many new species would result from work there. Herbert H. Smith apparently confined his collecting

to lower altitudes and the vegetation between 6,000 feet and snow-line is almost unknown.

2. The Atrato region. The forested area adjacent to Panama is very scantily represented in herbaria. Because of its geographical position valuable data could doubtless be obtained as to distribution of species.

3. Southeastern Colombia. Our two weeks' work at Toledo, near the Venezuelan border, led to the belief that the eastern

FIGURE 7. Tree of the Compositae family on the Paramo Romeral.

slopes of the Eastern Cordillera, including the Plains of Casanare and the Sierra Nevada de Cocui, would prove remarkably productive. The region could best be reached by Maracaibo and Cúcuta, the party going from Cocui southeast to Orocué, on the Meta River, then down this river and the Orinoco to the coast, thus including a preliminary survey of the untouched southeastern half of the Republic. To attempt to cover this area thoroughly in the immediate future is almost hopeless, but I believe the trip here outlined would prove most advantageous.

ELLSWORTH P. KILLIP.

UNITED STATES NATIONAL MUSEUM.

CACTI*

Cacti are confined naturally to America, and although most abundantly developed, both in size and numbers, in and near the American tropics, they are not confined to those regions. In the north-temperate zone the geographic ranges of a few kinds of prickly-pears (*Opuntia*) extend up into southern Canada, while in the south-temperate zone many kinds of cacti are found in Chile and Argentina. The occurrence of a few species of a certain genus (*Rhipsalis*) in Africa is attributed to the activities of migratory birds which are ravenously fond of such provender and thus assist in the wide dispersal of the cactus seeds. These particular plants are mistletoe-like both in habit and in the small pellucid glutinous fruits. A parallel example of distribution has rather recently come to light in southern Florida. The birds usually alight near the tips of branches of trees, and there the mistletoe-like cactus (*Rhipsalis*)—sometimes called pencil-cactus, on account of the slender pencil-like joints of the stem—grows on the oak trees, planted there doubtless by migratory birds coming up from the West Indies where the pencil-cactus in question, *Rhipsalis Cassutha,* is so plentiful in the forests.

The unusual characteristics of the cacti were promptly appreciated by the discoverers of the New World, for several kinds of flat-jointed cacti (*Opuntiae*) were taken back to the Old World by the European expeditioners in early post-Columbian times, and became naturalized in the Mediterranean region. Here they have since maintained a foothold. Again, towards the end of the last century, other kinds, presumably from Mexico and South America, were carried to Australia. But here, carelessly thrown away by settlers, these plant-strangers not only promptly became naturalized but overran the land like wild-fire, spreading both by vegetative parts and by seeds, thus furnishing a conspicuous example of how well the group had perfected its methods of propagation. They have already taken possession of millions of acres. The end is not in sight. To date, having defied all methods of extermination, they are spreading into new fields, entailing great financial losses.

* Abstract of a lecture and demonstration given in Conservatory Range No. 2 of The New York Botanical Garden on Saturday afternoon, January 29, 1927.

The great cactus centers are in the southwestern United States, in Mexico, in parts of South America, and in the West Indies. New York lies in one of the minor cactus areas—the eastern Coastal Plain, extending from Massachusetts to Florida. The real extent of this cactus field was not realized until lately.[1]

The ancestry of the cacti is obscure lost, together with much similar matter, in the wreckage of the later geologic times. There is not even an indication of their remote ancestors preserved as fossils. We may safely assume that during the wide-spread destruction of more recent geologic times, the cacti were safely preserved in the highlands, while those in the lowlands succumbed. Thus, the present cactus-population of the coastwise region and coastal plains was, evidently, derived from highland ancestors.

The cacti, in comparison with what we may term ordinary plants—herbaceous and woody—present a series of irregularities —exceptions to regular behavior in function and structure. They represent a kind of intermediate state. They are really neither herbs nor shrubs or trees. They resemble, on the whole, the latter category, but the wood is so scant and the soft tissue so abundant that, in bulk of one kind of tissue, they are herbaceous.

Functionally considered, several closely associated conditions stand out prominently. One of the most striking characteristics of cacti is the absence of leaves in the vast majority of the kinds. As deserts became the typical homes of cacti, leaves would be a distinct detriment to the plant, under the normal conditions existing there, for the moisture would be given off from the plant more rapidly than the roots could supply it from the scant reserve in the soil. So, leaves were in most cases long ago dispensed with, and the transpiration area reduced to the surface of the stem, which in all respects now functions as a leaf. Thus such nourishment as the plant can secure is used to build up stem-tissue, and ultimately flowers and fruits. The lack of leaves may account, at least in part, for the unusually large size or great number of flowers and fruits in proportion to the size of the plant or stem. In addition, the transpiration of moisture is also partly regulated—reduced or accelerated—from within the stem. The sap or cell-content is largely mucilaginous, and latex, or milk, is

[1] See Journal of The New York Botanical Garden **26**: 241–258, 265–285. 1925.

also sometimes present. The condition of this gummy cell-sap, regulated according to external conditions, when thicker checks transpiration and when thinner accelerates it accordingly. In addition, in case a plant is wounded, this mucilage promptly spreads a coating over the exposed tissues, and then forms a callus by which serious infection is prevented from gaining access to the internal tissues of the plant.

Cactus plants are often very adaptive to different kinds of habitats—even crossing the gap between the terrestrial and the epiphytic. The prickly-pear (*Opuntia*), prickly-apple (*Harrisia*), and dildoe (*Acanthocereus*) will grow on the limbs of broad-leaved trees in dry-land regions where seeds have been accidentally planted by birds, or in swampy regions where their normal habitat is in the trees above the ground which is too continuously wet to permit their roots to function properly.

Another group worthy of mention is semi-epiphytic, or more strictly speaking, petrophytic. This condition is well illustrated by the two tree-cacti (*Cephalocereus*) of the Florida Keys. Their habitat provides (or allows) boundless room for the aerial parts, but very little for the subterranean. The ponderous succulent trees grow on the plate-like surface of the oölitic limestone in the case of *Cephalocereus Deeringii*, and of the coral-limestone in the case of *C. keyensis*. The root-system of these plants compared with the aerial parts is almost negligible. Whatever soil is present to cover the roots is largely humus. Very likely a friendly mycorhiza helps in the remarkable growth of the plant.

Structurally considered, the cactus plant exhibits unusual forms from *seed* to *fruit*. The several characteristic structures, gross and fine, vegetative or floral, indicate a long and mighty struggle of the family to maintain itself against extinction. As a group and individually the plants have fortified themselves to resist and overcome adverse environments, have made trebly sure the propagation and maintenance of their kinds. Succulent tissues predominate from the roots to the fruits.

For example, the roots, the underground parts, of slender caliber often grow to great lengths in search of moisture and nourishment. In more favorable habitats the caliber of the roots increases and the length diminishes, sometimes to such a degree that they form thick, even globular, tuber-like structures. These

subterranean succulent structures, whether attached to or separated from the parent plant, may give rise to a new plant.

The stems, the aerial parts—varying from cord-like to columnar, barrel-like, tub-like, bowl-shaped, or pad-like—are abundantly stored with water and nourishment, and thus not only favorably adapted for resisting and surviving destructive desert conditions, under which most of them grow, but also for making possible a method of vegetative propagation, additional to the roots. The stems are either continuous or jointed. A stem or a section-"joint" thrown to the ground may give rise to new plants. The stems are often spine-armed, with the spines sometimes developed to such a degree that they hide the stems. The armament aids in increasing vegetative propagation, notwithstanding the fact that on first thought it might seem to diminish it as an agent to warn and keep animals away. However, the juicy stem or the enticing fruit lures many an animal to be a mechanical broadcaster of cactus plants. The tips of the spines are more or less barbed and although they penetrate the skin of the carrier with ease, they will maintain a tenacious hold in an animal's hide and may be carried and planted far from the parent.

Here may be mentioned the singular mechanics of the cactus stem—a mechanism to insure the longer life of the individual. For example, in the case of the columnar or cereoid types, with their mass of soft watery tissues, we do not find the stem round and even, but strongly, often copiously ribbed. The ribs, of course, give the axis added strength. On the other hand, the "joints" of the opuntioid kinds, that is, those plants with flattened internodes—"pads," as they are often called are often placed successively criss cross so that only about half the surface of the plant is exposed to the wind whichever way it may blow.

As mentioned above, the leaves have, in most cases, become rudimentary or been eliminated, the bark of the stem and branches and the armament functioning for the leaves as far as is necessary.

On the other hand, flowers and fruits are, in the present-day cacti, often produced in unusual quantities or bulk, compared with the vegetative part of the plant.

The flowers, usually conspicuous, often very showy, are especially adapted to insure propagation, in this instance by seeds. The flower may be described as funnelform, the tube (*hypanthium*) and limb (*perianth*) varying almost infinitely in pro-

portions of form and size. The showy perianth, either diurnal or nocturnal, white or of all shades of colors, except blue, is attractive to insects. Within are numerous, often almost myriad, stamens, whose anthers await the insect visitors with pollen ever ready to be transferred to the stigmas. The flowers, so unusual, in connection with the parts that bear them, render cacti very important horticultural subjects, whether used in the open in warm climates or under glass in the colder climes.

The fruits, too, are useful in ornamental gardening. These are of a multitude of shapes and sizes—mainly pear-shaped, club-shaped, barrel-shaped, egg-shaped, and globular. They exhibit shades of nearly all colors, except blue, and are dull or shiny. They are unarmed or spine-armed, and sometimes hairy. Unlike the flowers, which are short-lived, frequently only a day or a night, the fruits are usually long-persistent. Fresh and cured cactus-fruits have formed a very important, in fact almost indispensable, food in the life of aboriginal man in America since times remote. Take, for example, two instructive quotations from brave Alvar Nuñez Cabeza de Vaca, written in the early part of the sixteenth century:

"In order to cheer us, they would tell us not to dispair, since we would have tunas [prickly-pears] very soon and eat much and drink their juice and get big stomachs and be merry, contented and without hunger."

"During all the time we ate tunas [prickly-pears] we felt thirsty. To allay our thirst we drank the juice of the fruit, pouring it first into a pit which we dug in the soil, and when that was full we drank to satisfaction. The Indians do it in that way, out of lack of vessels. The juice is sweet and has the color of must. There are many kinds of tunas, and some very good ones, although to me all tasted well alike, hunger never leaving me time to select, or stop to think which ones were better."

It is a description that would almost fit certain tribes and seasons in America to-day—especially in the desert reaches of our own Southwest and Mexico. Some of the larger prickly-pears are gathered from both wild and cultivated plants, in great quantities and consumed in many of the larger cities.

And need we mention that the juice of some of the fruits of cacti is made into a primitive alcoholic drink? Other kinds furnish primitive man with a drug and a narcotic. This is notably

the case in the so-called "mescal button"—not to be confused with the mescal magueys of Mexico. The use of the mescal button, or peyote (*Lophophora*), among the Indians has its counterpart in our own present narcotic problem. Among some tribes it is even the basis of a religious cult.

As the "fruits" of the prickly-pear are mainly a modified "joint" or "pad," it may be proper to refer here to the use of these succulent stems as a vegetable in the cuisine of some present-day semiaboriginal peoples, and to refer again to two quotations from de Vaca which record that,

"We lost the trail and found ourselves in a big forest, where we gathered plenty of leaves [pads] of tunas which we roasted that same night in an oven made by ourselves, and so much heat did we give them that in the morning they were fit to be eaten." Also,

"and gave us of what they had to eat, which were leaves [pads] of tunas and green tunas baked."

The cactus confection made by impregnating the pulp of some of the larger kinds with sugar is well known. The cactus also serves as a forage plant for animals, wild and tame, when pasturage is lacking, in which case spineless or almost spineless plants have been selected or in the case of very spiny plants the armament is burned off prior to feeding. The spines themselves, in the case of some species, have been used as needles for phonographs and similar instruments.

Nor was only the fruit itself important. Among various primitive folk the seeds were and still are ground up for flour, and like the pulp of the fruits they are sometimes used as a coloring-agent or dye. In this connection it may be mentioned that various kinds of cactus plants serve as hosts for the cochineal scale-insect, the female of which yields a brilliant scarlet dye, and is also used medicinally.

Of late the cactus has come into its own as an élite house plant. Many a city apartment has a small cactus garden —in a large dish or a tray—comprising living specimens of the dwarf, often rarer species of our deserts. This fad may be useful in awakening the interest of the children of the urban deserts in plants, but, unfortunately, it has already resulted in the extinction of some colonies of the rarer species of our glorious unpeopled deserts.

JOHN K. SMALL.

TWO NATIVE BIGENERIC HYBRIDS

For over 25 years there have been in the herbarium of The New York Botanical Garden two sheets of a peculiar shrub of the Apple Family. They were collected in 1901 and 1902 by Brother Louis Arsène at a place east of Chapeau, on the French island of Miquelon, off the south shore of Newfoundland. In a note on the older sheet, the discoverer has made the statement that it is a very rare plant and that it has been collected only at the locality mentioned. On the other sheet is given the information that it grows 1–2.5 m. high. It represents without much doubt a bigeneric hybrid of the American Mountain Ash, *Sorbus americana* Marsh., and a Chokeberry, *Aronia atropurpurea* Britton. Its leaves are 2–7 cm. long, with the texture, pubescence, and tooth ing of the Chokeberry, but all, except a few of the earliest ones, have the lower portion pinnate, and the upper portion cleft or lobed, with the terminal segment large, thus approaching in shape those of the other parent. The inflorescence and flowers resemble those of *Aronia,* the former being small and with ascending branches. (See FIGURE A.)

The other bigeneric hybrid is represented by a sheet in the herbarium of the University of Minnesota. It was collected by William C. Cusick on mountain sides near Cornucopia, Oregon. The sheet bears the number 1380 and is erroneously labeled *Pyrus sambucifolia.* The label states also that it is a small straggling shrub. It is probably a hybrid between the Western Mountain Ash, *Sorbus occidentalis,* and a species of Juneberry, *Amelanchier.* The leaves have the light green color of *S. occidentalis,* but are thinner. Some of the earlier leaves are simple, but the rest are pinnate below, with 2 or 3 pairs of leaflets, which are like those of *S. occidentalis,* entire-margined below and dentate towards the apex. The terminal leaflet is much larger, broader, more toothed, and often lobed. The inflorescence is compound as in *Sorbus,* but the young fruit resembles that of *Amelanchier.* It is hard to tell which species of *Amelanchier* is the other parent, as the leaves (and also the leaflets) are more acute than in any of the Oregon species of the genus. I think that *A. florida* Lindl., however, is the most likely one, having more oblong leaves than the rest. (See FIGURE B.)

P. A. RYDBERG.

FIGURE A. *Aronia atropurpurea* × *Sorbus americana.*
FIGURE B. *Amelanchier florida*(?) × *Sorbus occidentalis.*

BOTANIZING IN THE MOUNTAINS OF COLORADO[1]

Several years ago the speaker had the privilege of spending a summer botanizing in the high mountains of Colorado. It is difficult for one living in the east to get a very clear idea of the size of some of these western states and to realize that Colorado is twice the size of the State of New York or as large as the whole of New England with the state of Indiana added.

We think of Colorado as a mountainous state, but as a matter of fact, one-third of this state consists of level and for the most part arid plains. After a trip from Chicago to Denver through the fertile valleys of the Mississippi and the arid plains of western Nebraska and eastern Colorado, one is able to appreciate more fully the significance of the term "wide expanses of the west" and many would be interested in finding at the foot of the Rockies one of the most thriving inland cities of America, the city of Denver, which was used as our headquarters during our stay in Colorado.

One of the first and most interesting mountain expeditions made was over the so-called Moffat Road, a road which was planned many years ago by David Moffat, one of the pioneers of Colorado, with the dream of connecting Denver and Salt Lake City by more direct route and opening up western Colorado, one of the most extensive undeveloped portions of the United States. At the time of our visit to Colorado this road had been completed just over the crest of the mountains and was operated as one of the most beautiful scenic railroads in America.

A temporary collecting base was established in Tolland, at an elevation of nearly nine thousand feet. From this point expeditions were made in various directions through the mountains and many interesting collections of fungi obtained. Since our visit to Colorado the builders of this scenic railroad have conceived and executed the plan of boring through the mountains for a distance of more than six miles in order to eliminate twenty-three miles of track and the difficulties of traversing the mountains during the winter season. This tunnel, completed during the past year, is the longest railroad tunnel in America.

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, June 18, 1927.

The most extensive collecting trip of our entire stay in Colorado was in the Geneva Creek Canyon, a branch of the Platt River Canyon. This is reached by taking the narrow-gauge line of the Colorado and Southern Railway, which ascends the canyon by keeping close to the river, a swift-flowing clear stream which as it falls over the rocks adds much to the beauty of the natural scenery of the canyon. Leaving Denver in the morning, we arrived at Grant about noon, a distance of nearly one hundred miles from Denver.

From this point we ascended the Geneva Creek Canyon by team to a distance of three miles. Here between two mountain streams is a small park in which a number of log cabins had been built to serve as temporary homes for summer resorters, and in one of these cabins we made our home for ten days. Our cabin was surrounded by numerous gulches and mountain streams and the most of our collecting was confined to these, since the mountain sides were too dry to afford much outside of a few of the larger woody fungi. The small creeks which flowed through these gulches were bordered with mossy bogs which furnished many species of the smaller fleshy fungi.

We extended our collecting trips up the canyon and on one occasion reached the crest of the mountain-range at a distance of from twelve to fifteen miles from our cabin and here attained an elevation of between 13,000 and 14,000 feet. Above timberline the conditions were not favorable for collecting fungi, as would naturally be supposed; but the speaker was surprised to find a few fleshy cup-fungi in mossy places even at some distance above snow-line. At the crest of the mountain-range vegetation of all kinds was very scant.

One of the most interesting spots visited in the vicinity of our cabin was Geneva Park. The term park as here used applies to any level valley between mountain-ranges. Geneva Park, which was located about three miles above our cabin, is at an elevation of between 9,000 and 10,000 feet and covers an area five to seven miles long and one to two miles wide. The approach leading to the park is very steep and rocky and probably represents the terminal moraine of a local glacier. The park would then result from the filling in of this natural reservoir with the wash from the mountain sides above. The entire region is surrounded by

mountains, except the comparatively narrow pass which furnishes an outlet for the creek which flows through it. The land itself is nearly level and the soil is swampy and furnishes a good substratum for fungi.

The lecture in which the experiences of this expedition were outlined in detail was well illustrated with numerous slides showing both the desert and mountain scenery of our Rocky Mountain state. While the object of the excursion was to collect and study the fungi of the region, some attention was also given to the higher plants and numerous colored slides were used to illustrate the gorgeous colors of the mountain flora.

FRED J. SEAVER.

RELATION OF SOILS TO PLANT GROWTH[1]

The speaker emphasized the close inter-relation between the soil, climate, and vegetation. Thus, in the United States, the various crop regions, such as the cotton belt or the wheat belt, are associated with fairly definite climatic zones and soil types.

The most important single factor in crop growth is the moisture in the soil. On the average about 400 ounces of water must be supplied to the plant for each ounce of dry material produced. Recent research has shown that the power of the soil to draw up water from below for the plant roots is much less than was formerly supposed, a conclusion that emphasizes the necessity of conserving the moisture in the top two or three feet of soil. This may be done by the incorporation of organic material such as barnyard manure, etc., and by maintaining a loose mulch of dried soil on the surface, which acts as a blanket and prevents evaporation. It is also necessary to keep the soil in a good physical condition, or tilth, so that the plant rootlets can readily ramify and penetrate the interstices of the soil in search of moisture. A good physical condition also encourages the activities of the soil micro-organisms whose functions are to break down the residues of vegetation and manures into simpler compounds that plants can

[1] Abstract of an illustrated lecture by the Assistant Director of the Rothamsted Experimental Station, England, given at The New York Botanical Garden on Saturday afternoon, June 4, 1927.

assimilate. These lowly forms of life—bacteria and fungi—are present in huge numbers in fertile soil. In one teaspoonful of soil the number of bacteria alone is several times greater than the entire population of the United States. The study of the soil population and its activities absorbs much of the activities of all agricultural experiment stations. The subject is highly complex, but it is possible that in the future methods of beneficial control will be evolved that will be as epoch-making for agriculture as was the introduction of artificial fertilizers.

The lecture was illustrated with lantern slides, which included photographs of some of the famous experimental fields at Rothamsted and a series of colored reproductions taken mainly from medieval tapestries and illuminated manuscripts showing the development of cultivation implements from their crude prehistoric form to their present pattern.

B. A. KEEN.

NOTES ON FLORIDA MOSSES[1]

The two Florida mosses exhibited were collected by Mr. Rapp in the vicinity of Sanford, a town situated on Lake Monroe, scarcely half way down the peninsular and some 30 miles inland from the Atlantic Ocean. This region has furnished a good many interesting species obtained by the same collector, although at an elevation of only a few feet above the ocean. The entire state, indeed, has no mountains and its highest hills have an altitude of only some 300 feet. Possibly the walls of sink-holes and more or less underground streams furnish shade and moisture somewhat similar to conditions in mountain canyons, thus permitting an unusual abundance and variety in the moss flora for so flat a country.

The first specimen shown ranks among the smallest of our mosses. On the bit of rock scarcely one-half inch square are doubtless 150 or more individual plants varying from one-half to one millimeter high and appearing rather like a greenish felt over the surface. The genus represented is *Splachnobryum*, of which

[1] Abstract of a report presented at the Conference of the Scientific Staff and Registered Students of The New York Botanical Garden on February 2, 1927.

there are some 34 described species, rather widely scattered over the world except in Europe, where no species has yet been found native. The genus was first observed in the United States growing on flower pots containing tropical plants, the original home of this particular species being unknown. Another species, previously known in Mexico, has recently been collected in Arizona by Bartram, while this Florida species makes the third found in the United States. The plants of this last are rather bud-like, with a few broadly ovate to oblong leaves, their margins crenulate nearly all round by the somewhat inflated cells. The longer leaves measure about one-third millimeter in length.

The second moss shown was of a very different class, ranking among the larger members of its genus and forming extensive green mats over the earth, with trailing stems several centimeters long. It is a species of *Oxyrrhynchium,* nearest related to *O. speciosum* of Europe, found rarely in Britain and in some of the central and southern alpine regions. The genus is characterized among other things by having a rough seta and the nerve of the leaf ending in a thorn-like point a little below the apex of the leaf on the under side. The Florida plant, although very similar to the European at first glance, seems constantly to differ slightly in the relatively shorter and broader stem-leaves and longer-pointed perichaetial leaves.

R. S. Williams.

PUBLIC LECTURES DURING SEPTEMBER AND OCTOBER

The free illustrated lectures of The New York Botanical Garden during September and October are given in the Museum Building on Saturday afternoons at four o'clock. Doors are opened at 4:15 to admit late-comers. The program follows:

Sept. 3. "The Big Trees of California," Dr. H. A. Gleason.

Sept. 10. "Rarer Wild Flowers of New York City and Vicinity," Mrs. N. L. Britton.

Sept. 17. "Some Successional Aspects of the Local Vegetation," Prof. George E. Nichols.

Sept. 24. "The Westchester County Park System," Mr. Jay Downer.

Oct. 1. "Dahlias" (Exhibit of living collection),
Dr. Marshall A. Howe.
Oct. 8. "In Southern California," Mr. Howard H. Cleaves.
Oct. 15. "Autumn Coloration," Dr. A. B. Stout.
Oct. 22. "The Campaign against Diseases of Our Food Plants,"
Mr. F. C. Meier.
Oct. 29. "The Flora of the Catskill Mountains,"
Prof. Oliver P. Medsger.

NOTES, NEWS, AND COMMENT

A period of violent thunder-storms during the latter part of July, with a total precipitation of 9.75 inches for the month, culminated on the afternoon of August 1st in one of intense violence and heavy rainfall, causing the Bronx River to rise over its banks and flood the north meadows and woods for the first time in several years, forming temporary ponds and pools in all the valleys and depressions, and washing banks and paths so as to require repairs at many places. At least four large trees were struck by lightning. Rainfalls during the month of August amounted to 9.97 inches, bringing the precipitation of the two months to the remarkable total of 19.72 inches. And September 1 added 2.69 inches!

Brother León, Professor in the College of La Salle, Havana, who came to New York to receive the honorary degree of Doctor of Science from Columbia University at the commencement exercises in June, has spent parts of June and July at the Garden, in continuation of studies of the Cuban flora, which in coöperation with members of the Garden staff, have extended over more than fifteen years. During this period he has made large collections of plants in all the provinces of Cuba, forming an herbarium at the College of La Salle, which has become the most important one in Cuba; duplicate specimens have been contributed by him to the herbarium of the Garden. His botanical exploration of Cuba has revealed many species new to science, and has added greatly to our knowledge of many others.

Miss Elsa Rehmann, Landscape Architect, of Newark, N. J., gave an illustrated lecture on July 9 at The New York Botanical

Garden on "The Landscape Treatment of Small Grounds." She is the author of recently published books entitled "The Small Place" and "Garden Making." In her lecture, Miss Rehmann dwelt particularly upon three important elements. First, she emphasized the importance of hedges and hedgerows, for the beauty of the small place depends upon its enclosure which separates it from its neighbor and makes it complete in itself. She took up, secondly, the planting against the house. She regrets the overemphasis of the miscellaneous evergreen planting, which she considers an unfortunate fad of the present and she looks forward to a finer understanding of this important subject, for as she put it, "trees, shrubs, vines, and flowers are not to be planted for themselves alone but are to be arranged and adapted to the house against which they are used." And thirdly, she suggested a few of the elements of the little flower garden, its placing, its background, its paths and borders, for the real beauty of the flowers gathered in a garden depends upon them.

Mr. Montague Free, Horticulturist at the Brooklyn Botanic Garden gave an illustrated lecture on "Rock Gardens" in the Museum Building of The New York Botanical Garden on Saturday afternoon, July 23. Mr. Free is a graduate of the Royal Botanic Gardens, Kew, England, and for many years has specialized in the cultivation of rock plants. Rock gardens, said Mr. Free, are becoming increasingly popular in this country. It is not at all surprising to those who know something of the beauty and fascination of alpine plants, which are largely used in the embellishment of rock gardens. Rock gardening is peculiarly well adapted to those who like to do their own gardening, and also to those who have the collector's instinct, because many of these alpine plants are so diminutive that a large collection of them may be grown on a very small area. About one hundred colored slides were used to illustrate the lecture. Some of these were obtained in Europe, illustrating European gardens, and some in this country. Among the interesting slides were those showing the famous rock garden at Friar Park in England, which contains a replica to scale of the peak of the Matterhorn, and covers several acres of ground. Many rare alpines were also illustrated, including such plants as the Lady of the Snows, *Anemone vernalis,* Saxifraga "Faldonside," *Oxalis adenophylla,* etc.

Meteorology for July. The total precipitation for the month was 9.75 inches. The maximum temperatures recorded at the Garden for each week were 87° on the 3rd, 82° on the 9th, *94° on the 13th*, 83° on the 20th, and 92° on the 29th. The minimum temperatures were *54° on the 1st*, 56° on the 5th, 58° on the 12th, 61° on the 24th, and 61° on the 26th and 28th.

ACCESSIONS

LIBRARY ACCESSIONS FROM MAY 1 TO JUNE 10, 1927

ASLIN, MARY S., *comp. Catalogue of the printed books on agriculture [in the Rothamsted experimental station library], published between 1471 and 1840, with notes on the authors.* n. p. 1926.

BABCOCK, ERNEST BROWN, & CLAUSEN, ROY ELWOOD. *Genetics in relation to agriculture.* Ed. 2. New York, 1927.

BABINGTON, CHARLES CARDALE. *Manual of British botany.* Ed. 10, *with amended nomenclature and an appendix, edited by A. J. Wilmott.* London, 1922.

BAILEY, HENRY TURNER. *The tree folk.* Cambridge, 1925.

BAILEY, LIBERTY HYDE. *The outlook to nature.* New and rev. ed. New York, 1924.

BARNARD, CHARLES. *The strawberry garden.* Philadelphia, n. d.

BARNES, PARKER THAYER. *House plants and how to grow them.* Garden City, 1923 [1909].

BARRON, LEONARD. *Lawn making, together with the proper keeping of putting greens.* Garden City, 1923.

BARRON, LEONARD, & OTHERS. *Flower growing, revised and adapted from the text of I. D. Bennett's "The flower garden."* Garden City, 1926.

BENNETT, IDA DANDRIDGE. *The vegetable garden, a manual for the amateur vegetable gardener.* Garden City, 1914.

BEVIS, JAMES FREDERICK, & JEFFERY, HENRY JOHN. *British plants; their biology and ecology.* Ed. 2. London, 1920.

BEWLEY, W. F. *Diseases of greenhouse plants.* London, 1923.

BEWS, JOHN WILLIAM. *Plant forms and their evolution in South Africa.* London, 1925.

BLACK, JOHN MCCONNELL. *The naturalized flora of South Australia.* Adelaide, 1909.

Botanische Abhandlungen; herausgegeben von K. Goebel. Heft. 1–10. Jena, 1922–26.

BOWER, FREDERIC ORPEN. *Botany of the living plant.* Ed. 2. London, 1923.

BROWN, HARRY BATES. *Cotton: history, species, varieties, morphology, breeding, culture, diseases, marketing, and uses.* New York, 1927.

PUBLICATIONS OF

THE NEW YORK BOTANICAL GARDEN

Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its twenty-eighth volume.

Mycologia, bimonthly, devoted to fungi, including lichens; $4.00 a year; single copies not for sale. [Not offered in exchange.] Now in its nineteenth volume.

Addisonia, quarterly, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Subscription price, $10.00 a year. [Not offered in exchange.] Now in its twelfth volume.

Bulletin of The New York Botanical Garden, containing reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations. Free to all members of the Garden; to others, $3.00 per volume. Now in its thirteenth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. Planned to be completed in 34 volumes. Roy. 8vo. Each volume to consist of four or more parts. 56 parts now issued. Subscription price, $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Memoirs of The New York Botanical Garden. Price to members of the Garden, vols. I–VI, $1.50 per volume; to others, $3.00. Vol. VII, $2.50 to members; to others, $5.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Vol. VII. Includes New Myxophyceae from Porto Rico, by N. L. Gardner; The Flower Behavior of Avocados, by A. B. Stout; Descriptions of New Genera and Species of Plants Collected on the Mulford Biological Exploration of the Amazon Valley, 1921–1922, by H. H. Rusby; and The Flora of the Saint Eugene Silts, Kootenay Valley, British Columbia, by Arthur Hollick. viii + 464 pp., with 47 plates, 10 charts, and 11 text-figures. 1927.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the twelfth volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

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Some of the leading features of The New York Botanical Garden are:

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THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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OF
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NOTES, NEWS, AND COMMENT

ACCESSIONS

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A view of the Museum Building of The New York Botanical Garden from the southwest. Photograph by Miss Fleda Griffith, September, 1927.

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TWO MIDSUMMER FLOWERING SHRUBS - ABELIA AND CLETHRA

The selection of flowering shrubs ordinarily observed about estates and private gardens, though usually of fine foliage during midsummer, seldom includes many particularly showy species. Except for the Hydrangea, which suffers from its overabundance, and possibly for the beautiful Rose of Sharon, there is lacking the brilliance and variety of the earlier-blooming shrubs. It is not because there exists a lapse in the succession of blossoming plants that this condition prevails. It is rather due to the fact that the midsummer shrubs are as yet, for the most part, unknown to the public. More than that, they are unheard of, nonexisting, so far as many are concerned. It cannot be because they, very often, are exotics, for many importations have become well established, as one sees in the Forsythias. The responsibility probably rests upon the nursery people and others who ultimately are the fashion creators.

Two of the flowering shrubs that might well be more employed in landscape work are the *Abelia* and *Clethra*, the former of immigrant parentage, the latter of native origin.

Abelia grandiflora, the only representative of its genus in the Garden, may be seen blooming during midsummer in three prominent places about the grounds. The largest group fills the great circle just north of the bridge behind the Museum, another is located at the northeast corner of the Two Hundredth Street entrance, and the third is just across the path on the east side of the Rock Garden.

This *Abelia* is of horticultural origin, a hybrid, one of the choicest of its genus, for it blooms continuously for almost five months, from June to November. From one of its parents, *A. uniflora,* an Asiatic species, it has acquired a half-evergreen tendency and this character of its bright green leaves, turning bronze in the autumn and persisting well into the winter, together with its lingering pretty pink flowers, makes this shrub a most desirable plant. It is a more delicately formed plant than most others; its foliage is not dense; in fact, when viewed in contrast with the heavy Philadelphus and Deutzias, it may appear almost leafless from a distance and unattractive were it not for the pretty little flowers that are the more conspicuous by virtue of this fact. Its other parent, *A. chinensis,* also is of Asiatic origin.

The genus *Abelia* contains some twenty-seven different species confined to the northern hemisphere. One species occurs in the Himalayas, two others in Mexico, and the remainder in eastern Asia.

Among the half dozen or more species that have been introduced into cultivation, *Abelia grandiflora* is distinguished by its sepals, which vary from two to five on the same plant and frequently are connate, giving the appearance of cleft sepals. In fact, the structure of the calyx serves well in separating most all the species. *A. grandiflora,* commonly known as the Garden or Hybrid Abelia, stands between two other groups by virtue of its variable number of sepals, between those whose sepals number two and those of five. In fact, these two characters have very obviously been combined in *A. grandiflora,* for one of its parents, *A. uniflora,* has two sepals and the other, *A. chinensis,* has five.

In addition to *Abelia uniflora* there are four other Asiatic species characterized by having two sepals per flower. One of them is *A. Engleriana* from central and western China, whose flowers about a half inch long distinguish it from the larger flowers of an inch or more of *A. Schumannii.* The two other two-sepaled species are *A. Graebneriana* of central China and *A. serrata* of Japan. The first of these has the larger flowers, an inch long, distinguished by their pink color and yellow throats, on single-flowered peduncles. *A. uniflora,* the fifth in this group, has rosy white flowers with yellow or orange throats on one- to three-flowered peduncles or grouped in loose terminal panicles.

FIGURE 1. *Abelia grandiflora.* From specimens growing in The New York Botanical Garden, September, 1927.

In the group of five sepals there are four species. *Abelia chinensis* of China has funnel-form white flowers a half inch long in terminal dense panicles; *A. triflora* of the Himalayas has tubular corollas, white, flushed pink; *A. floribunda* of Mexico has larger flowers, one and a half inches long, tubular and carmine

purple, its leaves are persistent, and *A. spathulata* of Japan has flowers almost as long, white, tinged yellow in the throat.

There is one other species in Manchuria, *Abelia biflora,* characterized by four sepals. Its flowers are white, tubular, and in pairs.

So widely distributed a genus as is *Abelia* naturally varies considerably in hardiness of its species. *A. Graebneriana* and *A. Engleriana* are probably the hardiest, while *A. triflora, A. chinensis,* and *A. grandiflora* are less so, though the last of these three, as is well evidenced in the Garden, may become well established in the latitude of New York and even farther north.

The second midsummer flowering shrub that we shall consider is a native plant, a member of a genus which, however, is also widely distributed over the northern hemisphere. It is the Sweet Pepperbush, *Clethra alnifolia,* whose flowers are among the most deliciously fragrant that grow in swamps and wet woods along the Atlantic seaboard from Maine to Florida. Several groups of this fine shrub occur about the grounds. It is of very different form as compared with *Abelia.* Its clean compact habit, forming a fine globular shrub up to ten feet in height or massed together in a border grouping, is equally pleasing. And then when the blossoms appear, fragrant erect white racemes four to five inches long that cover the plant as so many erect candles set about it, Sweet Pepperbush is indeed a thing of beauty. Two varieties of it are known which unfortunately are absent from the collections in the Garden. The one, var. *rosea,* has pinkish flowers and the other, var. *paniculata,* is characterized by narrower, glabrous, less toothed leaves.

There is a very fine mass of this shrub at the Shelter House on the Herbaceous Grounds. It may also be found about the lake north of the Museum and again in the collections of the Fruticetum, just south of the Two Hundred and Fourth Street stairway.

In this last site it is associated with two other members of its genus. The Mountain Sweet Pepperbush, *Clethra acuminata,* one of these, is also a native species normally inhabiting the Alleghany Mountains from Virginia to Georgia, a rather restricted range. The other is an exotic from eastern Asia, *Clethra barbinervis,* the Asiatic Sweet Pepperbush. This latter species is not so compact as the common native one; in fact, it reaches tree size,

FIGURE 2. *Clethra alnifolia*. From specimens growing on the grounds of The New York Botanical Garden, September, 1927.

attaining a height sometimes of thirty feet. It, too, has very fine white racemes. Of these three species that are together in the Fruticetum, *C. acuminata* is distinguished by its usually solitary racemes. The other two, whose racemes are generally panicled, differ among themselves in the number of veins in their leaves. *C. alnifolia* has seven to ten pairs, while *C. barbinervis* has ten to fifteen pairs.

Altogether, there are about twenty-five species of *Clethra* widely distributed, as already mentioned, in America, eastern Asia, and

in isolated Madeira off the northwest coast of Africa. In addition to *C. alnifolia* and *C. acuminata* there is one other native species, *C. tomentosa,* which ranges from North Carolina to Florida and Alabama.

Clethra Fargesii, a shrub from central China, is one of the most ornamental on account of its very long racemes, sometimes over half a foot in length. A close relative of it, *C. monostachya,* also from central China, is distinguished by usually solitary rather than panicled racemes. *C. Delavayi* is regarded by Rehder as the handsomest of the Chinese species. It attains tree size and is characterized by red branchlets, pubescent leaves, solitary racemes, and red calyxes.

There are three evergreen species in this genus, *C. arborea* from Madeira, *C. quercifolia* from Mexico, and *C. tinifolia* from Jamaica.

The genus *Clethra,* its common generic name being White Alder, is in its own monogeneric family, *Clethraceae,* a branch of the order Ericales. *Clethra* prefers a moist, sandy, and peaty soil.

EDMUND H. FULLING.

CONTRASTS BETWEEN THE ALPINE FLORAS OF THE EASTERN AND WESTERN UNITED STATES, AS OBSERVED BY AN AMATEUR BOTANIST[1]

The speaker is Field Secretary of the National Conference on State Parks, and in the course of a survey of the country covering many state parks, and some national parks, noted the differences in plant species on which his talk was based. He said that while his observations in the East were fairly comprehensive, those in the West were not so wide, but that the differences noted by him were apparent to any one having the opportunity to study the alpine flora of both sections. He offered the suggestion that these contrasts might be due to differences in glaciation during the Pleistocene, as affecting survivals of species driven south, and afterward retaking alpine and subalpine altitudes. A simpler ex-

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, July 16, 1927.

planation was given to him, however, by Dr. Arthur Hollick, of the staff of The New York Botanical Garden, an eminent authority on paleobotany, who said that the fossil evidence of late Miocene and Pliocene vegetation indicates that a differentiation of the eastern and western floras was more or less established in pre-Pleistocene time, and that the existing alpine floras merely represent the remnants in each region of the flora that was already established there in pre-Pleistocene time.

The talk was illustrated with lantern slides of mountain scenery, and of the types of plants on which his lecture was based. The speaker said, in part:

"I had climbed, previous to three years ago, many of the high mountains of New England and New York, and had explored the higher Appalachian ridges in the Middle Atlantic states, and had become fairly well acquainted with the alpine and boreal flora found on them, relics of the conditions existing in these latitudes during the Glacial Period, and in many cases isolated on peaks to which they had retreated after the disappearance of the continental ice sheet, and literally marooned on these mountain tops, as on islands, while these species in lower altitudes had gone far northward, since the warming of the climate after the close of the Glacial Period had made low level situations unsuitable. I found it intensely interesting, in climbing some of the peaks of the Presidential Range in New Hampshire, or Mount Mansfield and Couching Lion in Vermont, of Mount Marcy and Mount MacIntyre in the Adirondacks, to see on these bleak mountain tops, above the last fringe of subalpine fir and spruce, on the short grass and lichen-covered ledges of their summits, what subarctic conditions existed at these altitudes. It was especially striking on Mount Katahdin, in Maine, which, a hundred miles farther north than Mount Washington, presents, on its broad and lofty tableland, a bit of Labrador or South Greenland. I recall with what a thrill my friend J. A. Allis and I found on the wall of the beetling South Basin of Katahdin, a plant which puzzled us, but which was identified for us at The New York Botanical Garden as *Chondrosea Aizoon,* a tiny plant of the Saxifrage family, found further north and in northern Vermont but not before reported in Maine.

"I think that the enthusiastic amateur botanist comes to have more admiration and affection for these alpine plants than for any

others; they seem so sturdy, so self-reliant, so defiant of cold and ice and wind, so well equipped to maintain their stand in these bleak places, so quick to flower and fruit in the short and uncertain summer that is given them between the last snowstorm of June and the first in September. One of my favorites is the Three-Toothed Cinquefoil, *Sibbaldiopsis tridentata,* because I have seen it on so many mountains, from Maine to North Carolina, and to meet it on the trail is always a sign that the summit is not much farther above. I recall climbing Whiteface, in the Adirondacks, in dense rainclouds, unaware how near I was to the top, when I emerged from a tunnel under the firs to come upon ledges where it grew; then I knew the summit must be near, and so it proved.

"Trips in the western mountains, as well as in the Southern Ap palachians, which I was able to make in the course of field-work for the National Conference on State Parks, permitted me to make the acquaintance of the alpine flora of summits in Colorado, Nevada, and Washington, and of plants at slightly lower levels in other states.

" One thing struck me about the western alpine plants, and gave me food for thought which inspired the explanation here attempted; that the families to which the most numerous species belong are noticeably different from the families of our eastern mountain flowers. Our eastern alpine plants, in genera, species, and individuals, are most numerously represented by the Heath Family. Anyone who has climbed in the Adirondacks or New England will recall them; the blueberries and bilberries, the mountain cranberry, the bearberry, the Lapland rosebay, the dwarf laurel, the Labrador Tea, Phyllodoce, Harrimanella, the creeping snowberry, and those depauperate heaths, the Crowberry and Broom Crowberry. They make up the Alpine Garden on Mount Washington, with the exception of the mountain sandwort, in the Pink Family, and the Diapensia of the Diapensiaceae. Most of these heaths are found much farther north, and there are other species in the family that extend to the last limits of vegetation.

" Now, in climbs to 13,000 feet on the Continental Divide, in the Rocky Mountain National Park in Colorado, to over 12,000 feet on Mount Whitcomb in Nevada, and up to the level of permanent snow and ice on Mount Rainier in Washington, I was en-

tranced with the beauty and wealth of the alpine flora, but there were none of my eastern Heath Family friends. On Thatchtop Mountain, 12,600 feet, in Colorado, up which I climbed 4,500 feet, from the heavy timber, the most striking plant was a Mertensia, the Lungwort, quite like our common eastern species, tall and many flowered at 8,000 feet, and diminishing up to the summit to a tiny form an inch high with a single flower. On Whitcomb in Nevada and on Rainier in Washington, in late summer, the most numerous flowers were the Painted Cups, or Indian Paint Brush, as they are locally called, *Castilleja,* in the Figwort Family, and the Penstemons, or Wild Foxgloves, of the same family.

"The Heath Family is not absent, as any good list of western mountain plants, such as in Dr. F. W. Schmoe's 'Our Greatest Mountain,' will show. There are some blueberries and huckleberries, a pink and white heather, and a white rhododendron in mountain meadows, and Pyrola and Indian Pipe are found in the high forests. But it did not seem to me that the heaths had anything like the pervasive control of above timber line areas which our eastern heaths possess. On the slopes of Rainier, Penstemon and Painted Cup reached the snow line; on the Continental Divide, besides the dwarfed Mertensia, a curious Gentian, *Gentiana frigida,* with a tiny rosette of leaves and one large green, purple-splotched flower, and a remarkable composite, *Rydbergia,* with a golden disk disproportionately large for its leaf system, were the noticeable species.

"Considering the possible reasons for the dominance of the heaths in our eastern alpine flower associations, and their relative weakness in the west, I wondered if differences in glaciation in the Pleistocene could be invoked as an explanation. In the East the continental ice sheet extended much further south than in the West, where the glaciation was largely from the mountains outward. Heaths are dominant Arctic plants, and when driven south by the ice, persisted in front of its terminal moraines and followed it back, as it stagnated and melted away. Some were marooned on mountain tops and are now found hundreds of miles south of their fellows in subarctic latitudes. They found temporary refuges as far south as New Jersey, where there are such curious survivals as the Bearberry and Broom Crowberry, in the Pine-barrens west of Barnegat Bay.

" It seemed to me that in the mountainous West the plants fleeing south would not have found such friendly refuges as in the lowlands of the Atlantic seaboard in which to persist until they could go back north. Was it possible that fewer boreal and alpine plants survived the Glacial Period? It seemed to me that many of the present high mountain species in the West are such as we scarcely associate with alpine conditions in the East; *Mertensia, Penstemon,* and *Castilleja* seemed to me like former lowland plants that had learned to climb the mountains and live there.

" However, Dr. Arthur Hollick, to whom my amateur theories were submitted by Mrs. Elizabeth G. Britton, at my request, has given a simpler and better explanation, based on his wide knowledge of the factors in the problem. He says:

" ' I am inclined to think that a more simple explanation is to be found in the fact (as demonstrated by rather meager remains of late Miocene and Pliocene vegetation) that a differentiation of the eastern and western floras was more or less established in pre-Pleistocene time, and that the existing alpine floras merely represent the remnants in each region of the flora that was already established there in pre-Pleistocene time. We are not justified, as far as I am able to interpret the facts, in visualizing the glacial conditions in the western mountains as markedly different from those in the East.' "

RAYMOND H. TORREY.

HASTENING THE LIFE ACTIVITIES OF PLANTS BY CHEMICALS[1]

This paper is a discussion of the ability of certain chemicals to increase the life activities of plants. These chemicals are not fertilizing elements, and plants in their natural growth do not encounter them. Thus it has been found that after certain fruits have been picked from the plant the process of coloration can be hastened by adding to the air surrounding the fruit a small quantity of the gas known as ethylene. The amount of ethylene necessary to produce this result is surprisingly small about one cubic

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, August 13, 1927.

foot of ethylene per carload of fruit. This method was first applied commercially in the coloration of citrus fruit, and subsequently has found application in the blanching of celery, reddening of tomatoes, etc. The advantages and disadvantages of its use are discussed. It is shown that the life processes of the fruits are markedly stimulated by this small amount of gas. This increase in life activity results in a doubling of the rate of respiration of the treated fruits.

Further illustrations of the capacity of small amounts of chemicals to influence the growth of plants are given by the effect of several chemicals upon the sprouting of potatoes. Freshly harvested potatoes, if replanted under conditions that are usually favorable for growth, will not produce sprouts promptly. The potato tuber takes a period of rest extending from 2 to 6 months. At the end of the rest period sprouting will begin. It has been found that the length of the rest period may be shortened by treating the potatoes with small amounts of chemicals such as ethylene chlorhydrin, sodium thiocyanate, and thiourea. The gain in time of sprouting varies from 2 to 6 weeks, depending on the variety of potato and stage of dormancy of the tuber. The chemical known as thiourea has the peculiarity of inducing the formation of several sprouts at each eye of the potato where ordinarily only one sprout will be produced. Preliminary experiments indicate that early blooming of woody shrubs such as lilac and flowering crabapple can be brought about by treatments with certain of these chemicals. This would extend the period over which these plants would be available for ornamental purposes.

F. E. Denny.

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Yonkers, New York.

RARER WILD FLOWERS OF NEW YORK CITY AND VICINITY[1]

It seems rather absurd and a somewhat doubtful procedure to talk of "Rare Wild Flowers" within the limits of New York City, but when we realize the extent of Greater New York, it becomes evident that there must still be localities where some of the native American plants grow wild. Many wild flowers have been introduced from Europe and elsewhere and these as a rule are more common and abundant than many of our native ones. Such, for instance, are the common species of plantain, known to the Indians as "white man's foot-prints," the dandelion and butter-cups, the white-weed or daisy, Bouncing-Betty, "butter and eggs," and many other less attractive weeds which have come in, either as garden plants and escaped from cultivation or been introduced in hay, and as impurities with other seeds and been scattered in various ways into distant and seemingly inaccessible places. In fact, much has been written about these introduced "weeds" and their numbers like those of other introduced "pests" is rapidly increasing. Many of our native plants are shy and relatively less abundant. This is particularly true of the Spring flowers and some of the Autumn ones. Some of these that bloom early in the year are nearly or quite extinct in localities where they used to be abundant. The trailing arbutus or May-flower, bloodroot, columbines, hepatica, lilies, and trilliums are no longer found where they used to grow. The shrubs that bear showy blossoms, such as wild azalea, dogwood, laurel, magnolia, and rhododendron, also have suffered, particularly from the thoughtless breaking and depredations of people who go out in motors to spend the day in the country. Efforts are being made to educate the public to their danger by distributing literature, publishing illustrations of those that need protection, printing cartoons showing the effect of this selfishness and thoughtlessness and holding exhibitions at State and County Fairs to show the results "before and after." The Garden Clubs and Federations of Women's Clubs are all helping and the schools in their nature-work are teaching the children to respect the rights of others and to help to protect our

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, September 10, 1927.

native plants. The Press also has been most helpful, printing editorials and cartoons, trying to teach the public good manners out of doors, and showing how badly those who love the wild flowers feel about their destruction.

Mrs. Britton showed 136 hand-colored slides of some of the plants that used to grow within the limits of the Botanical Garden and its vicinity, and some of the rarer wild flowers which formerly grew on Staten Island and Long Island and in portions of Westchester County. No present locations for them were indicated.

The Torrey Botanical Club began its activities for the study of the local flora between 1865 and 1867, over 60 years ago, and in its Herbarium, which was donated to the Garden, may be found many rare specimens of plants which formerly grew where the city has now completely obliterated the localities where they were found. In Brooklyn, where the Ferry House of the Fulton Ferry was, *Clematis ochroleuca* once grew. Rare orchids were collected on Manhattan Island; arbutus and holly used to be abundant on Staten Island; cardinal flowers, fringed gentians, and moccasin flowers once grew in Van Cortlandt Park. If cameras had been as common when the Torrey Botanical Club was founded as they are now, it would have been possible to secure many pictures which have vanished; so Mrs. Britton advises all the members of the Walking Clubs to go "botanizing with a camera" and "bird-hunting with an opera glass" and to record their finds as Mr. Swift is doing in the *New York World* in the "News-out-of-doors." She warns us against fire and vandalism and asks for help in making New York State beautiful. A state law protects the birds and some of the wild flowers, particularly dogwood and laurel, arbutus and moccasin-flower.

To those who have gardens it will be possible to save some of the native things by transplanting them from localities where they are liable to be exterminated, such as state roads under construction, building operations, and "improvements" of all kinds that deface and mar the beauty of nature. Many wild flower gardens and sanctuaries exist in the vicinity of the city and even within its limits. At the Brooklyn and New York Botanical Gardens some of our most beautiful and rarer native plants may still be seen, either wild or under cultivation.

ELIZABETH G. BRITTON.

TREES OF GREATER NEW YORK[1]

The speaker referred to the area covered by Greater New York, the five boroughs being equal in size to nearly one-third of the state of Rhode Island, and more than five times the area of the District of Columbia. Although the population of Greater New York is half again as great as that of the whole state of Massachusetts, the metropolitan district is not, as every New Yorker knows, all a region of sky-scrapers and apartment houses. There are still large sections with woods and fields, in addition to a park system totalling more than 8,000 acres, much of which is kept in a state of nature. Probably the greatest amount of wild land is found in Staten Island, particularly in the southern and western parts. Large wooded sections occur in Queens, especially along the ridge north of Jamaica and Hollis, marking the terminal glacial moraine, and also in the neighborhood of Flushing. Much of Forest Park is natural woodland. In the Bronx, much of Van Cortlandt Park and of Bronx Park have been preserved as far as possible in their original condition. The country in and about Pelham Bay Park is also an attractive region for botanical exploration. Even in much-settled Manhattan, Inwood Park, at the extreme northern end of the borough, is a wild, wooded section; and a small part of Central Park, particularly at the north end, is natural woodland. All these areas are easily accessible to the New Yorker by subway, trolley, or bus connections.

Laying particular emphasis on the native trees of the region, the speaker showed colored slides, about 75 in all, illustrating the distinguishing features of the various kinds, with particular attention to the native oaks and hickories. Nine species of oaks and four kinds of hickories are common in the greater city, and can be readily distinguished with a little practice, the lecturer stated.

The trees in the crowded sections of the city and in some of the parks suffer a great deal from dust, smoke, and gases, although some are more susceptible than others to this injury. In particular, the Ailanthus, or Chinese Tree-of-Heaven, shows wonderful adaptability to city life, and deserves a great deal of credit.

Although a beginning has been made in this direction, more care should be exercised in regard to the soil surrounding the

[1] Abstract of an illustrated lecture given on Saturday afternoon, August 20, 1927, at The New York Botanical Garden.

bases of the trees in our parks. Instead of the dry, hard, down-trodden condition so commonly found, it should be made to resemble the soft spongy floor of the forest as nearly as possible, by loosening up the top layers and laying on a mulch of dead leaves or well-rotted manure.

ARTHUR HARMOUNT GRAVES.

GLADIOLI[1]

If there is a flower fully qualified to be in every summer garden it is the gladiolus. The continued increase of its use in suburban gardens, where many-colored spikes may be seen at this time, suggested the desirability of further use in the city. A casual view of window and roof gardens of the city failed to show any gladiolus in bloom. The bulbs thrive in boxes or pots, if well tended, and they have bloomed profusely in apartment house courtyards, where the sun comes part of the day. The various formal concrete boxes and wall containers about the other houses will also serve to grow them.

Of all the garden uses of the gladiolus, the most prominent is that of cut flower. A single row, a double row, or many rows down the length of the garden not only give the garden color but provide much material for home and church decoration, for neighbors, or for hospitals. The following cultural notes give concise directions:

ESSENTIALS OF GROWING GLADIOLUS

(by the New England Gladiolus Society)

New Purchases—Expose corms to air and keep in a cool, dry cellar or closet.

Time to Plant—After danger of freezing has passed, or when trees begin to unfold their leaves.

Where to Plant (Soil)—Best results will be obtained from a sandy loam; a heavy clay soil will not give good results.

Planting and Fertilization—Large corms give best results when planted at a depth of about four inches, in rows, beds, or borders,

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, August 27, 1927.

from four to eight inches apart. Plant only in open sunny places, away from trees, large shrubs, or foundations of buildings. Small corms should be planted about three inches deep. Place bulbs with eyes upward. The best method of planting is to scoop out a trench with a hoe or plough, slightly deeper than needed—spread a little sheep fertilizer, bone meal, or tankage in trench; then cover fertilizer with a little earth and place corms in position—add more earth and then a little more fertilizer. Never allow fertilizer to come in contact with corms, but when plants are six inches high a little fertilizer between rows will improve quality of blooms. A heavy dressing of barn manure in the fall is sufficient for all needs and gives best results. Do not plant gladiolus in the same patch many years in succession.

Cultivation—Keep soil loose and free from weeds. Hoe and cultivate frequently. The more you cultivate the better the reward. Watering during long, dry spells will be helpful—then soak ground thoroughly and cultivate shortly after.

Cutting Cut with a sharp knife, allowing at least four leaves to remain on the stalk.

Care of Cut Flowers—Change water and shorten stems daily, removing about one-fourth inch of stem; cut diagonally with sharp knife.

Harvesting—Dig corms when tops discolor or in late fall, and immediately after digging cut stem close to bulb.

Curing –Dry in wind or warm room. Remove the roots and withered corms as soon as they separate easily. Store bulbs in a cool, dry cellar in open boxes or baskets.

Some of the new varieties exhibited to visitors at the lecture were Fischer's Henry C. Goehl, Mrs. F. C. Peters, Mrs. Wm. E. Clark, Sunnymede, John Alden, Miss T. Rose, Prima Donna, Dr. R. T. Jackson, and Ethelyn; Metzner's Rosenel and Marietta; Gage's Alma Gluck and Maurice Fuld; Dr. Hoeg's Gold; Kemp's Marnia; Prestgaard's Carmen Sylva; Coleman's Sheila; Brown's Tiffany, Melba, and Carnival; Diener's Rose Ash and Mrs. Leon Douglas.

The change in varieties may be noticed by comparing those common ten to fifteen years ago with our present collection. Of thirty-five of these varieties only Baron Hulot, Niagara, Mrs. F. Pendleton, Dawn, and Glory remain. The change results wholly

from the activity of American bulb-growers. Their enthusiasm has made this country the first in production of this magnificent flower.

KENNETH R. BOYNTON.

PLANNING NEXT YEAR'S ROSE GARDEN[1]

One of the points strongly brought out was the fact that one does not need to go to great expense in digging holes three feet deep for the culture of roses. If the soil is well drained and there are from 12 to 18 inches of good garden loam mixed with a little well-rotted cow manure, it is sufficient for the culture of roses. Of course, there are certain types of roses that will withstand a very sandy soil, such as the Rugosas, while other types are fond of a clay loam.

Another point that was clearly made was the fact that the speaker considered it a mistake to plant roses deeply in the soil in order to prevent the appearance of the wild shoots from budded stock. He claims that the best method of planting to-day is to fit the roses into the soil up to where the bud has been inserted, prune the rose roots with a sharp pair of pruning shears, cutting them square across and fitting the roots into the soil in a downward position. He also mentioned that the teas and hybrid teas should be cut back to from three to five buds, allowing from four to five good, strong stems for growth, while the hybrid perpetuals should be cut back to eight and ten buds. Rosarians differ on these points.

He mentioned that the use of standard roses is growing in favor but that in a cold climate the stem, which is usually Rugosa stock, frequently splits and should be protected during the winter. All of these points should be thought of in placing the roses in the garden. The main thing is to get your soil prepared, work it thoroughly for either fall or spring planting.

A careful spray outline was suggested and considerable was made of the use of flowers of sulphur. He also mentioned the use of tobacco stems in the soil if troubled with aphids.

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, August 6, 1927.

In selecting varieties for next year's planting mention was made of Emily Gray as one of the finest yellow climbers, but the speaker stated that he wished this rose might be hardier for cold climates. Around New York and to New Jersey it does beautifully. He also mentioned the Climbing American Beauty, which is more of a bush rose than a climber, very hardy, and beautiful. Of course, the Silver Moon for white, Doctor Van Fleet for pink, and Doctor Huey for a deep red. Mention was made also of the Irish Fire Flame as a single rose, and particular mention was made of the Isabel, which the speaker stated was a combination of sunset and sunrise in color. He feels that the finest white rose for the garden is the Frau Karl Druschki. A prolific bloomer among the red varieties is the Gruss an Teplitz.

Everyone was urged to join the Rose Society and keep in touch with the best information on rose culture in America.

HUGH FINDLAY.

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NEW YORK CITY.

SOME SUCCESSIONAL ASPECTS OF THE LOCAL VEGETATION[1]

Twenty-five thousand years ago nearly all of New York and New England lay buried beneath a vast accumulation of ice. Plant life was practically absent. Retreating northward at the close of the Ice Age, the melting glaciers uncovered mile after mile of soil and rock, utterly destitute of organic life. Immediately thereafter commenced a migration into this unpopulated territory of plants from farther south, from regions beyond the reach of the ice sheet. Eventually, and in a manner which may well be described as evolutionary, our present vegetation was developed. The process has been a slow one. Very likely the first plant cover to establish itself on the freshly exposed land mass was of the type to-day found in the far north, where trees are mostly absent and tundra prevails. Later on, as climatic and soil conditions became increasingly favorable for trees, the tundra

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, September 17, 1927.

became replaced by forests: evergreen forests of fir and spruce, similar to those which now characterize northern Maine and eastern Canada. Then, as deciduous broadleaf trees pushed their way northward, the forest came to be made up of a mixture of deciduous and evergreen trees; and finally the broadleaf trees became predominant, as they remain to-day. (Changes in vegetation of the sort here described, whereby one kind of vegetation becomes replaced by another, are termed Succession.)

Changes in vegetation due to changes in climate naturally take place very slowly. But similar changes due to other causes may be brought about with considerable rapidity, and the so-called phenomenon of Succession affords one of the most instructive points of view from which to study plant life. Changes in the character of natural vegetation may result through the activity of man or animals, through the activity of floods and other physiographic agencies, or through the activity of fire. The most interesting of all such changes, however, are those which are due to the activities of the plants themselves. On abandoned farms, for example, bushes and trees growing up in an old pasture tend to shade out and replace the grasses, so that the grassy pasture gradually becomes transformed into a brush lot. Mosses and lichens growing on the surface of an otherwise bare rock create soil conditions which are favorable to grasses and shrubs, only to be exterminated as these latter become established. Woodlands of light-requiring trees tend to become displaced by forests of shade-tolerant trees. Water lilies and other aquatic plants may gradually bring about the filling in of a pond, and in so doing prepare the way for other groups of plants, thereby paving the way for their own extermination. And so on. Any piece of ground, if left to itself, may become occupied successively, within a comparatively short span of years, by a whole series of plant communities, each of which represents a stage in the development of what is termed the climax type of vegetation. In this region the climax type of vegetation is a mixed deciduous-evergreen forest and it is toward this type that vegetation everywhere, through the phenomenon of succession, tends to progress.

About 75 lantern slides were used to illustrate the talk.

GEORGE E. NICHOLS.

YALE UNIVERSITY,
NEW HAVEN, CONNECTICUT.

NOTES, NEWS, AND COMMENT

Dr. Fred J. Seaver recently spent a day in Stamford, Conn., as a guest of "The F. A. Bartlett Tree Expert Company," looking over the experimental work of Dr. W. H. Rankin on the effect of various filling substances in the treatment of wounds in trees. Various materials and combinations of materials are used for filling artificial wounds and the effect will be studied by a trained scientist over a period of years. The object of the work is to ascertain the merits and demerits of tree surgery and if possible to place this work on a more scientific basis.

The visitors to the Garden library during the summer months included the following botanists: Mr. Lyman B. Smith, Winchester, Mass.; Dr. Ivan M. Johnston and Prof. Carroll W. Dodge, Cambridge, Mass.; Prof. C. L. Wilson, Hanover, N. H.; Prof. H. H. Whetzel, Ithaca, N. Y.; Mr. Yngve Ahlstrom, Harrisburg, Pa.; Messrs. E. P. Killip and Dow V. Baxter, Washington, D. C.; Prof. B. W. Wells and Mr. Larry A. Whitford, Raleigh, N. C.; Prof. Leslie A. Kenoyer, Kalamazoo, Mich.; Mr. H. Teuscher, Morton Arboretum, Lisle, Ill.; Prof. G. W. Martin, Iowa City, Ia.; Mr. and Mrs. Arthur Svihla, Morgan City, La.; Prof. John T. Buchholz, Austin, Tex.; Prof. and Mrs. Carl Epling, Los Angeles, Calif.; Mr. and Mrs. C. E. Horne, San Juan, P. R.; Mr. James A. Faris, Central Baragua, Cuba, and Prof. Carl G. Dahl, Alnarp, Sweden.

At the International Congress of Plant Sciences (Fourth International Botanical Congress) held at Ithaca, New York, in August, 1926, an invitation was conveyed from British botanists for the Fifth International Botanical Congress to be held in England in 1930. The invitation was accepted by the botanists assembled at Ithaca, and arrangements are now being made for the Congress to be held at Cambridge about the middle of August, 1930. An Executive Committee has been formed to make arrangements for the Congress, consisting of Dr. F. F. Blackman, Prof. V. H. Blackman, Dr. E. J. Butler, Prof. Sir John Farmer, Prof. F. E. Fritsch, Prof. Dame Helen Gwynne-Vaughan, Dr. A. W. Hill, Prof. W. Neilson Jones, Sir David Prain, Dr. A. B. Rendle

(Treasurer), Prof. A. C. Seward (Chairman), Prof. W. Stiles, and Prof. A. G. Tansley. It has been decided to organize the Congress in the following seven sections: Morphology (including Anatomy), Palaeobotany, Plant Geography and Ecology, Taxonomy and Nomenclature, Genetics and Cytology, Physiology, and Mycology and Plant Pathology. Mr. F. T. Brooks, The Botany School, University of Cambridge, England, and Dr. T. F. Chipp, Royal Botanic Gardens, Kew, England, have been appointed Honorary Secretaries of the Congress, and any communications with regard to the Congress should be addressed to one or other of the Secretaries.

In the lecture hall of the Museum Building of The New York Botanical Garden, on September 24, the Westchester County Park System was explained by Jay Downer, Chief Engineer, who stated that the system now comprises more than 16,000 acres of land and includes waterfront parks on the Hudson River and Long Island Sound, interior parks and reservations throughout the County, with a system of connecting parkways. The first large scale recreational development to be completed by the Commission is at Tibbetts Brook Park in Yonkers, immediately north of Van Cortlandt Park. Mr. Downer stated that the mammoth concrete swimming pool, supplied with pure filtered water, which is included in this development, is the most popular feature yet opened to the public by the Commission. Thousands of people have used the pool during the past summer. This park was reclaimed from waste swamp lands and other recreational features include a 13-acre athletic field, children's playgrounds, and a boating lake, one-half mile long. The Commission's largest recreational development is now under construction at Rye Beach and will be opened to the public in 1928. Two old amusement parks and many old buildings have been torn down to clear the ground for the new amusement park known as "Playland," which has been laid out in the form of an exposition, arranged along a central midway and including the latest types of roller coasters and other amusement devices. The new amusement park will represent a total investment for land and development work of about $5,000,000, and will be entirely self-supporting through revenues derived from the amusement enterprises and concessions. An-

other project attracting widespread interest is the Westchester County Center, the principal feature of which is a large auditorium building on the Bronx River Parkway at White Plains, which will seat 7,000 people. For Westchester County it will serve a purpose similar to Madison Square Garden and be used as a central meeting place for music festivals, flower shows, industrial expositions, inter-scholastic athletic meets, and other similar purposes. The site for the auditorium is being prepared and construction will be started at an early date. The Commission also has under construction the Saw Mill River Parkway and the Hutchinson River Parkway, both of which will be similar to the Bronx River Parkway, which is now world-famous.

Meteorology for August. The total precipitation for the month was 9.97½ inches. The maximum temperatures recorded for each week were *86° on the 5th*, 83° on the 9th and on the 13th, 82° on the 17th and 76½° on the 25th. The minimum temperatures were 49° on the 3d, 51° on the 9th, 51° on the 16th, and *47° on the 25th.*

ACCESSIONS

LIBRARY ACCESSIONS FROM MAY 1 TO JUNE 10, 1927 (*CONTINUED*)

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BULLER, ARTHUR HENRY REGINALD. *Researches on fungi.* Vols. 2, 3. London, 1922–24.

BURBIDGE, FREDERICK WILLIAM. *Cultivated plants; their propagation and improvement.* Edinburgh, 1877.

BURKETT, CHARLES WILLIAM. *Farm crops.* New York, 1913.

CARTER, HUMPHREY GILBERT. *Genera of British plants.* Cambridge, 1913.

COLLINS, JAMES FRANKLIN, & PRESTON, HOWARD WILLIS. *Illustrated guide to the wild and commonly cultivated trees of the northeastern United States and adjacent Canada.* New York, 1912.

COPELAND, EDWIN BINGHAM. *The coco-nut.* Ed. 2. London, 1921.

CROY, MAE BELLE (SAVELL). *1000 hints on flowers and birds.* New York, 1917.

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CURTIS, CARLTON CLARENCE. *A guide to the trees.* New York, 1925.

CURTISS, DANIEL S. *Wheat culture.* Ed. 4. New York, 1920.
DAVIS, KARY CADMUS. *Horticulture; a text-book for high schools and normals.* Philadelphia, c 1919.
DICK, JOHN HARRISON. *Commercial carnation culture.* New York, 1915.
———. *Sweet peas for profit.* New York, 1914.
DIXON, ROYAL, & FITCH, FRANKLYN EVERETT. *Personality of plants.* New York, 1923.
DOUGLASS, BENJAMIN WALLACE. *Fruit-growing.* Indianapolis, c 1922.
ELLSWORTH, RODNEY SYDES. *The giant Sequoia.* Oakland, 1924.
FRASER, SAMUEL. *American fruits; their propagation, cultivation, harvesting and distribution.* New York, 1924.
GUILLIN, R. *Analyses agricoles; terres, engrais, fourrages, produits des industries agricoles.* Ed. 3. Paris, 1926.
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HÉRAUD, A. *Nouveau dictionnaire des plantes médicinales.* Ed. 6. Paris, 1927.
HUME, HARDRADA HAROLD. *The cultivation of citrus fruits.* New York, 1926.
Illustriertes Gartenbau-Lexikon. Ed. 4, *herausgegeben von Dr. Paul Graebner und Willy Lange.* Vol. 1. Berlin, 1926.
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KAINS, MAURICE GRENVILLE. *Home fruit grower.* New York, 1918.
KING, LOUISA (YEOMANS). *The beginner's garden.* New York, 1927.
KNOWLTON, FRANK HALL. *Plants of the past; a popular account of fossil plants.* Princeton, 1927.
KOSTYTSCHEW, S. *Pflanzenatmung.* Berlin, 1924.
KROK, THORGNY OSSIAN BOLIVAR NAPOLEON. *Bibliotheca botanica suecana ab antiquissimis temporibus ad finem anni 1918.* Uppsala, 1925.
KRUHM, ADOLPH. *The vegetable garden, revised and enlarged . . . from the original text of I. D. Bennett.* Garden City, 1926.
LÖHNIS, FELIX. *Vorlesungen über landwirtschaftliche Bakteriologie.* Ed. 2. Berlin, 1926.
LONGYEAR, BURTON ORANGE. *Trees and shrubs of the Rocky Mountain region.* New York, 1927.
MACGREGOR, JESSIE. *Gardens of celebrities and celebrated gardens in and around London.* Philadelphia, n. d.
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MATHEWS, FERDINAND SCHUYLER *Field book of American wild flowers.* New ed. New York, c 1912.
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MILLS, ENOS ABIJAH. *The story of a thousand-year pine.* Boston, c 1914.
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PADDOCK, WENDELL, & WHIPPLE, ORVILLE B. *Fruit growing in arid regions.* New York, 1914.
PARSONS, SAMUEL. *The art of landscape architecture.* New York, 1915.
PEETS, ELBERT. *Practical tree repair.* Rev. ed. New York, 1925.
PEMBERTON, JOSEPH HARDWICK. *Roses; their history, development and cultivation.* Ed. 2. London, 1920.
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THOMAS, GEORGE CLIFFORD, Jr. *The practical book of outdoor rose growing.* Philadelphia, 1914.

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GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 35,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific, and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated undor the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

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OF
THE NEW YORK BOTANICAL GARDEN

THE BOTANICAL INVESTIGATION OF NORTHERN SOUTH AMERICA, A TRI-INSTITUTIONAL PROJECT: ITS AIMS AND ITS NEEDS

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THE BOTANICAL INVESTIGATION OF NORTHERN SOUTH AMERICA, A TRI-INSTITUTIONAL PROJECT: ITS AIMS AND ITS NEEDS

It is now almost ten years since the National Herbarium at Washington, the Gray Herbarium of Harvard University, and The New York Botanical Garden ratified an informal agreement to coöperate in the investigation of the flora of northern South America. The reason for coöperation was simple: the task was too big for any one of them to attempt alone. With the expiration of the first decade of joint effort, it may now be well to summarize its progress, its results, and its needs.

Knowledge of the flora of northern South America was by no means lacking ten years ago. Each of the six countries or colonies comprising our investigational territory had been visited repeatedly by botanists, beginning with Aublet and Mutis, who were contemporaries of Linnaeus. We need only mention here the work of Melinon and Sagot in French Guiana, of Hostmann and Kappler in Surinam, of Schomburgk and Jenman in British Guiana, of Fendler, Moritz, and Spruce in Venezuela, of Triana, Holton, and Lehmann in Colombia, or of Jameson in Ecuador, while the extensive exploration of Humboldt had penetrated into several of these regions. But the abundant and important material collected by these early botanists had been permanently deposited in European herbaria long before the great development of botanical science on this side of the water, and only a relatively few duplicates had reached America. The literature dealing with these floras was scattered through hundreds of volumes. Not one of the six countries possessed a flora comparable with Britton and Brown's Illustrated Flora or Gray's Manual; only the Dutch

colony of Surinam boasted any recent and comprehensive list of its plant inhabitants.

It was certainly high time for American botanists to become interested. American trade routes were being opened, American capital was developing the natural resources in mining, forestry, and agriculture, and it was very obvious that American scientists would soon be called on to furnish the requisite information for further commercial development. As a matter of fact, the coöperating institutions have been called on repeatedly for such information during the past decade, and notwithstanding our continued effort for ten years, we are still unable to furnish all the assistance needed.

The New York Botanical Garden was fortunate at the inception of the project in having access to the old collections in the Columbia College herbarium, into which Dr. Torrey had been able to incorporate possibly three thousand specimens of the early collectors. We had also approximately a thousand specimens from Venezuela, collected by Weiss and Schmidt and by Rusby and Squires, a large collection by Johnston from the island of Margarita, a thousand or more of the Lehmann collections from Colombia, and nearly three thousand specimens from Colombia collected by H. H. Smith. The Samuels collection from Surinam had recently provided us with some five hundred sheets, and the great collection of Rusby and Pennell had just added nearly five thousand sheets from Colombia.

The coöperative work since that time has fallen into two general categories, the collation and coördination of existing knowledge and the extension of knowledge by exploration and research.

Since the older collections are almost entirely in Europe, the first of these categories has necessitated travel and study in Europe, where our own specimens may be compared with the authentic material of the early collectors, upon which all published information has been based. Five recent trips to Europe have been devoted primarily to this purpose by Dr. S. F. Blake and Mr. E. P. Killip, of the National Herbarium; Dr. I. M. Johnston, of the Gray Herbarium, and Dr. N. L. Britton and myself. Still more extensive and intensive study in Europe will be necessary before our American enterprise can stand entirely independent of foreign collections. Early descriptions of plants

are frequently vague or incomplete and of little value in the careful identification of our specimens. In such cases expert examination of original material is necessary and must be continued until every species of the region is represented by specimens of proven authenticity in American herbaria. In other words, the actual plant material, which has been the basis of all our previous knowledge and which must be the foundation for our present investigation, must be duplicated in our American institutions.

Of equal importance, but of much greater interest to the average citizen, is our work in extending knowledge through botanical exploration and collection. To that end, the three institutions have repeatedly sent botanists into South America, who have in some cases revisited the collecting grounds of the early explorers in order to duplicate their material and in other cases have entered botanically unknown territory. Our chief expeditions and their general results have been as follows:

In French Guiana, Mr. W. E. Broadway in 1921, 1,020 collections.

In British Guiana, Dr. A. S. Hitchcock in 1920, 1,140 collections; Dr. H. A. Gleason in 1921, 940 collections.

In Venezuela, Mr. W. E. Broadway in 1923, 819 collections.

In Colombia, Dr. H. H. Rusby and Dr. F. W. Pennell in 1917, 4,810 collections; Dr. F. W. Pennell, Mr. E. P. Killip, and Dr. T. E. Hazen in 1922, 7,148 collections; Mr. E. P. Killip and Mr. Albert C. Smith in 1926, about 7,200 collections.

In Ecuador, Dr. J. N. Rose in 1918, 1,994 collections; Dr. A. S. Hitchcock in 1923, 2,137 collections.

In Curaçao, Aruba, and Bonaire, Dr. N. L. Britton and Dr. J. A. Shafer in 1913, 254 collections.

In Trinidad, Dr. N. L. Britton in 1920 and 1921, assisted by Mrs. Britton, Dr. T. E. Hazen, and Dr. F. J. Seaver, about 3.500 collections.

In addition to this extensive material, we have also received from northern South America by exchange, purchase, or from resident collectors about 1,000 specimens from French Guiana, over 5,000 from British Guiana, about 3,000 from Venezuela, over 1,000 from Colombia, over 1,500 from Trinidad and Tobago, and a small number from Ecuador. As a result, our herbarium now contains certainly more than fifty thousand sheets to be used as

material for research, and similar increments have been received by the Gray Herbarium and the National Herbarium.

In spite of this great accumulation, there are still numerous parts of the territory poorly represented in our collections. Our material from all parts of French Guiana and Surinam is inadequate. The hinterland of these two colonies and of adjacent British Guiana is entirely unrepresented, although the region is known to contain a very rich flora. The great mountain range extending west from Mt. Roraima in British Guiana along the southern boundary of Venezuela to the great bend of the Orinoco is still a botanical *terra incognita,* although its remarkable plant life has been barely touched by a few British explorers on Mt. Roraima. The eastern slopes of the Andes in Colombia and Ecuador are still unexplored, and it is here that the extraordinary flora of the Amazonian lowlands enters our territory. The coast of Ecuador north of Guayaquil has not been examined. Much more work is still necessary in the mountainous parts of Colombia and Ecuador, where every mountain range and every alpine *páramo* supports its own group of endemic species.

The great bulk of these extensive collections of recent years has been identified and deposited in our herbaria, where it serves as reference material for the future. Some hundreds of new species have been detected and described. But the project demands and deserves some expression which will be of still greater usefulness. This should, and eventually will, take the form of published floras, in which all the plants of each country will be treated in a single publication, and which will be immediately useful not only to other botanists, but also to foresters, to agriculturists, and to men of intelligence generally whose business or personal interest makes botanical information necessary or desirable.

As a further contribution to this end, The New York Botanical Garden in 1924 entered into coöperative relations with the Royal Botanic Gardens at Kew, England, for the joint preparation of a flora of British Guiana. Work on this flora has been in progress for three years, but much more time and field exploration will be necessary if a volume of satisfactory completeness is to be produced. Messrs. Freeman and Williams, of the Trinidad Agricultural Experiment Station, are making good progress in the preparation of a flora of Trinidad and Tobago. A flora of Colombia is

also under contemplation, as well as monographic works dealing with particular families. Of such publications, two have already appeared. Dr. A. S. Hitchcock has published monographs of the grasses of British Guiana and the grasses of Ecuador, and these two are among the few comprehensive and authoritative works dealing with any extensive group of the region after a century and a half of botanical study. Mr. Henri Pittier has published an analytical key to the families of Venezuelan flowering plants, which may be expanded into a flora of that country. His thorough botanical exploration of many parts of Venezuela is noteworthy.

Mention has already been made of the calls for botanical information frequently received by us. The most extensive of these demands comes from the Tropical Research Foundation, which now has under way a survey of the forestry resources of the region, and which naturally turns to us for accurate advice on the numerous botanical questions involved.

The immediate needs of the project are threefold and all of them may be translated into a need for further financial support. Firstly, we need increased opportunity for additional botanical study in Europe, leading to the eventual duplication of the European store of knowledge in our three institutions. It is not too much to ask that one or another competent botanist spend six months in Europe every year. Secondly, we need additional funds for exploration and the accumulation of additional material. Expeditions to certain parts of our field are relatively easy and comparatively inexpensive, while the more difficult exploration of Mt. Roraima and the adjacent mountains and of the eastern slopes of the Andes might well be shared by other institutions interested primarily in the zoology or geology of the region. Resident collectors should be maintained in the field, particularly in those regions where forest industries appear especially promising. Thirdly, we need additional man-power in each of our three institutions, not merely to handle the material as it comes in, but to study the material properly and to publish the results for the general welfare.

H. A. GLEASON.

THE IRIS GARDEN ENTRANCE AND BOUNDARY FENCE ADJOINING

A notable and useful improvement has recently been effected along the southwestern boundary of The New York Botanical Garden in Bronx Park, on the eastern side of the Southern Boulevard, the northern side of Pelham Avenue, and at the junction of these two streets. The handsome and substantial boundary fence, work upon which has been in progress at intervals during several years, has been completed; this consists of a low stone base and coping, with stone piers about twenty-five feet apart and eight feet high, supporting bays of iron pickets. Except where interrupted by entrances, and by the Linnaean Bridge over the Bronx River, this boundary fence now extends along the whole Southern Boulevard frontage of the Garden and along Pelham Avenue from the Southern Boulevard easterly nearly to Bronx Park East, a total length of about 3,300 feet. It forms one of the most elegant park enclosures in the United States, and has been constructed through funds obtained by the Managers of the Botanical Garden, without cost to the city. Driveway and path entrances have been built at suitable intervals, also by funds received as gifts and bequests.

The total cost of this fence and entrances has been about $55,000, not including labor charges for grading and drainage, nor for plants and planting. As the work has proceeded, its great importance as a protection for natural features and plantations has been increasingly evident.

The last of these entrances, completed early in October at the junction of the Southern Boulevard and Pelham Avenue, has been built by means of a generous gift made for the purpose by Mr. Frank K. Sturgis, a vice-president of the Board of Managers.

Mr. Brinley has given us the following notes upon this beautiful structure; and to him and to Mr. Louis F. Bird, of his staff, we are indebted; as also to the efficient contractor, Carlo Pinchetti.

"The planning of an adequate entrance on the corner at the intersection of the Pelham Parkway and the Southern Boulevard was rather a difficult problem to solve. However, by combining low wing walls with heavy entrance posts, it was possible to create a broad and imposing gateway. Terminating the enclosing iron

fence with widely separated piers, a low curving wall leading to the recessed main entrance piers permits ample vision for drivers of vehicles leaving and approaching the Garden, thus making safe an otherwise difficult intersection with these two highways.

"The architectural style of the entrance is that of the Renaissance period, in harmony with the other Garden entrances. The main piers are surmounted by suitable vase-form finials. A background of rolling tree-covered hills gives a setting of natural beauty and it is the purpose to supplement this background with a low plantation of ornamental conifers."

The bronze tablet affixed to one of the piers of this entrance bears the following legend:

THIS GATEWAY IS DESIGNED
TO PERPETUATE THE MEMORY OF THE
LYDIG FAMILY WHO RESIDED ON THE
BRONX RIVER AT WEST FARMS FROM
1802 UNTIL 1884
ERECTED BY F. K. STURGIS
1927

Mrs. Sturgis, who materially aided the Garden in many ways during her life, was Miss Florence Lydig.

The driveway and paths running northerly from this entrance lead to the Iris Garden. Some additional planting of trees and shrubs within the Garden has been done to complete the landscape treatment at this point.

The improvements have been accomplished in consultation with Hon. Joseph H. Hennessy, Commissioner of Parks of the Borough of The Bronx, and his engineers. Commissioner Hennessy has recently obtained from the Board of Estimate and Apportionment an appropriation for the construction of concrete sidewalks on Pelham Avenue, from the Southern Boulevard to the Bronx River, thus notably supplementing the improvements above described. It is expected that construction of the sidewalks will soon be commenced. Altogether, these works are another example of cordial coöperation between the Park Department of The Bronx and The New York Botanical Garden.

N. L. Britton,
Director-in-Chief.

INDEX LONDINENSIS

A NEW GUIDE TO PLANT PORTRAITS

The only standard work of reference for one who wishes to discover illustrations of flowering plants and ferns, Pritzel's *Iconum Botanicarum Index,* is now more than sixty years old and correspondingly out-of-date. The rapid acceleration of the development of botanical and horticultural literature, and the cheapening of the processes for the reproduction of illustrations, have caused the need of an adequate index to be felt more and more keenly. For many years there has been kept up, at the Royal Botanic Gardens, Kew, a manuscript supplement to Pritzel's work, and at last, in 1917, arrangements were made for its revision and publication by the Royal Horticultural Society. Dr. Otto Stapf, who had been a member of the Kew staff continuously from 1891, was placed in editorial charge of the undertaking, which proved so vast and time-consuming that those not directly in touch with its progress have often wondered whether it would ever actually appear.

Now, however, a printed prospectus announces that volume I is ready for the press, and it looks as if the greatest lacuna in the current literature of botany and horticulture were about to be filled. The new Index Londinensis[1] is to comprise six quarto volumes (uniform with the well-known Index Kewensis, and like it with three columns to the page), and is expected to appear in the three years 1928, 1929, and 1930, two volumes each year. It is to include all of the hundred thousand references of the old " Prit-

[1] Iconum botanicarum index londinensis, sive G. A. Pritzel's Iconum botanicarum index locupletissimus emendatus auctus et ad annum MCMXX productus.—Index londinensis, containing illustrations of flowering plants, ferns, and fern allies; being an amended and enlarged edition of Pritzel's alphabetical register of representations of flowering plants and ferns, compiled from botanical and horticultural publications of the XVIIIth and XIXth centuries. (The publication price is £25 to those who pay in full in advance, or £27 to those who subscribe in advance and pay in instalments; after publication the price will be at least £30. Subscriptions should be addressed " To The Secretary, Royal Horticultural Society, Vincent Square, Westminster, London, S. W. 1 ").

zel" of sixty years ago, augmented by about three hundred and fifty thousand more, to illustrations most of which were published during the years 1866 to 1920.

It is needless to say that every botanist (unless his work is wholly restricted to cryptogamic plants) will find this work almost as important as the Index Kewensis and will need a copy within easy reach; if this is impossible, he will find his work greatly hampered. To the horticulturist it will be even more important than the Index Kewensis; for although illustrations of the innumerable garden forms are not included, there are given references to all figures of horticultural importance, including the principal cultivated varieties. In this connection it must not be forgotten that the work is issued under the auspices of the world's most famous horticultural society.

It is to be hoped that this undertaking will be pushed to its completion as rapidly as now planned, and that it will be possible before the end of the year 1930 to relegate to shelves, where they may be preserved for the admiration of future generations, the few copies that have not been completely worn out by more than half a century of constant use, of Pritzel's marvelous Iconum Index. It is also to be hoped that every botanist and every horticulturist will take the necessary measures immediately to assure to himself an accessible copy of this most important "tool of his trade."

JOHN HENDLEY BARNHART.

SMALL GARDEN COMPETITION UNDER AUSPICES OF THE NEW YORK BOTANICAL GARDEN, 1928

A. *Purpose.*—The keynote of this competition is to popularize possibilities in the treatment of small (one man or woman) gardens with a maximum of taste and a minimum of expense. This must be kept constantly in mind by all competitors.

B. *Open Competition.*—The competition is open to all persons, professional or amateur, other than landscape architects and employees or members of staff of The New York Botanical Garden.

Copies of this program may be obtained at The New York Botanical Garden or will be mailed on request.

C. *Prizes.*—The first prize is $100 cash. The New York Botanical Garden also undertakes, during the spring or early summer of 1928, to lay out and plant, in a prominent location in its grounds, a garden on the lines of the winning design, and maintain the same as a public exhibition prize garden for at least one year.

The winner of the second prize will receive $75 cash.

The winner of the third prize will receive $25 cash.

D. *Publicity.*—Wide publicity will be given to this competition; the names of the winners will be published and due credit for the authorship of the winning plan will be accorded in any public notice which may be posted in or on the prize garden referred to in the preceding paragraph (C).

E. *Jury of Award.* The jury will consist of three distinguished garden experts—one nominated by The Garden Club of America, one nominated by The Federated Garden Clubs of New York State, and one by The New York Botanical Garden.

F. *Conditions.*—(1) The plot to be covered is approximately 40 x 52 feet. These dimensions must be strictly observed. All plans must be scaled ¼ inch to the foot.

(2) No competitor may submit more than one plan.

(3) Plans shall be rendered in ink on mounted drawing paper, size of sheet 13″ x 18″. Color may be indicated but no perspective, picture, or photograph will be considered. If, however, a fence, pergola, or other construction is contemplated and can not be easily described, a simple sketch, sufficient to indicate the idea, may be submitted, but, as a rule, architectural features are to be avoided.

(4) Every plant, shrub, etc., must be given a key number and its position clearly located on the plan.

(5) The character of all material employed must be plainly indicated on the plan, which may also describe any special purpose which the garden is intended to serve, such as "Front Yard," "Back Yard," or "Suburban Garden."

(6) Each plan must be accompanied by a legible specification of all plants or shrubs employed, detailing the color, quantity, and the key number thereof. No expensive plants or shrubs are to be used. Annuals are permissible, but hardy perennials are preferred. Regard must be had for maintaining a succession of

bloom for spring, summer, and autumn, with harmonious color as the keynote and with due consideration of climatal conditions. A fence, pergola, brick or stone path, or any other appropriate accessory may be indicated; but architectural features requiring skilled labor and increasing expense are highly undesirable and competitors are cautioned to avoid such features. In considering cost, the jury will assume that all plants are to be developed from cuttings, roots, divisions, bulbs, or seeds to minimize expense.

. (7) The winning plans (1st, 2nd, and 3rd prizes) shall be the sole and exclusive property of The New York Botanical Garden, which shall own the copyright, photograph rights, and every other right and title connected therewith.

If full postage be included for that purpose, unsuccessful plans will be returned. But all plans submitted are wholly at the senders' risk and The New York Botanical Garden assumes no responsibility therefor.

G. *Submission of Plans.*—I. Plans must be submitted on or before 12 o'clock (noon) of the first day of March, 1928. No plan received after that day and hour will be considered.

II. Plans must be addressed to

Prize Garden Competition,
The New York Botanical Garden,
Bronx Park, New York City.

The outside wrapper may bear some return name and address to comply with postal regulations, but the identity of the competitor must not thereby be disclosed.

III. Each plan must be forwarded flat or rolled (not folded). To it there must be firmly attached a plain, sealed, opaque envelope containing the name and address of the sender. *No identification mark of any kind must appear on the envelope, plan or specification.* Disregard of this requirement will absolutely disqualify the sender. Each envelope and plan will be marked as received for identification by the Committee but no envelope will be opened until the jury shall have rendered its decision.

Should the jury report that no plan submitted is of sufficient merit to justify an award as outlined in paragraph C, The New York Botanical Garden reserves the right to withhold such award or awards.

In the first Small Garden Competition, conducted under conditions essentially as above, the awards made in March, 1926, were as follows:

1. The first prize of One Hundred Dollars to Mr. Archie S. Hill, Wauwatosa, Wisconsin.
2. The second prize of Seventy-five Dollars to Mrs. William Harris Cary, Brooklyn, New York.
3. The third prize of Twenty-five Dollars to Mr. L. L. Blundell, Brookline, Massachusetts.

A garden in general accordance with the first-prize plan was laid out and planted by The New York Botanical Garden, early in 1926, a little to the northeast of Conservatory Range 1. It has attracted wide attention and will be maintained as a public exhibit in 1928. The three prize-winning plans were published in the JOURNAL OF THE NEW YORK BOTANICAL GARDEN for April, 1926.

In the second Small Garden Competition, the awards made in March, 1927, were:

1. The first prize of One Hundred Dollars to Mr. L. L. Blundell, Brookline, Massachusetts.
2. The second prize of Seventy-five Dollars to Mrs. James Stewart, Easton, Maryland.
3. The third prize of Twenty-five Dollars to Mr. James D. Graham, Brookline, Massachusetts.

The three prize-winning plans were published in the JOURNAL OF THE NEW YORK BOTANICAL GARDEN for April, 1927. The first-prize plan was published also in HORTICULTURE for May 1, 1927. A garden embodying the general ideas and most of the details of the first-prize plan was laid out and planted by The New York Botanical Garden a little to the northwest of Conservatory Range 1. It will be maintained during 1928.

PUBLIC LECTURES DURING NOVEMBER

The free illustrated lectures of The New York Botanical Garden during November are given in the Museum Building on Saturdays at 3:30 P. M. Doors are opened at 3:45 to admit latecomers. The following is the program:

Nov. 5. "The Selection of Shrubs for Home Planting," Prof. Victor H. Ries.
Nov. 12. "Plants that are Attractive in Fruit," Mr. Kenneth R. Boynton.
Nov. 19. "Ferns as House Plants," Dr. Ralph C. Benedict.
Nov. 26. "Virus Diseases of Plants," Dr. L. O. Kunkel.

NOTES, NEWS, AND COMMENT

During the autumn, Dr. A. B. Stout spent a week in Maine in studies in the nursery and the field plantings of poplars, giving special attention to the hybrid seedlings produced two years ago. These studies are being made in coöperation with the Oxford Paper Company. Another week was spent at the State Experiment Station at Geneva, N. Y., in completing the work done this year in the breeding for new varieties of hardy seedless grapes.

Mr. Kenneth R. Boynton, Head Gardener, recently visited Washington, D. C., where he arranged for additional succulent plants from Dr. J. N. Rose, for new forms of Crotons and *Amaryllis* from the United States Department of Agriculture, and a collection of citrus relatives from the famous collection assembled by Dr. W. T. Swingle. These include Tabog, Kumquat, Wampi, the ornamental finger-lime, the Australian Desert Kumquat, and many other rare kinds which are both ornamental, especially in fruit, and useful, as stocks for the grafting of citrus fruits.

The 1928 exhibit of the Holland bulb trade in The New York Botanical Garden arrived on October 19th, in the shape of 21 cases of about 73,000 tulips, 150 varieties. These were grown by

many of the large firms, were assembled and shipped by Messrs. M. Van Waveren & Sons, of Hillegom, under the direction of Dr. M. Van Toulon Van der Koog, eminent secretary of the Dutch Bulb Exporters' Association at Haarlem. One notable section of this year's consignment of concentrated flower beauty is a group of ten rare varieties of the new Mendel tulips, or Christmas Flowering tulips, used for early forcing.

In a second paper on "Additions to the Australian Ascomycetes," Dr. Ethel McLennan and Isabel Cookson, of the University of Melbourne, have reported three species of *Lamprospora* which were collected and named by Dr. Fred J. Seaver from material collected in and about The New York Botanical Garden. The three species are as follows: *Lamprospora tuberculata* Seaver; *Lamprospora tuberculatella* Seaver; *Lamprospora Maireana* Seaver. An Australian variety of a fourth species has been established, *Lamprospora areolata* Seaver, var. *australis* McLennan and Cookson. Two of the above-named species are known only in New York and Australia. Misses McLennan and Cookson indicate their intention of continuing their survey of the Discomycetes of Australia and it is very interesting to note the cosmopolitan habits of some of the fungi.

Meteorology for September. The total precipitation for the month was 2.99 inches, of which 2.42 inches fell on the first day of the month. The maximum temperatures recorded at the Garden for each week or part of a week were 85° on the 4th, 87° on the 7th, *91° on the 15th,* 80° on the 25th, and 84° on the 30th. The minimum temperatures were 56° on the 5th, 48½° on the 9th, 52° on the 13th, *46° on the 25th,* and 50° on the 28th.

Meteorology for October. The total precipitation for the month was 7.81 inches. The maximum temperatures recorded at the Garden for each week or part of a week were *91° on the 2nd,* 79° on the 6th, 75° on the 12th and 13th, 67° on the 22nd, and 77° on the 28th. The minimum temperatures were 63° on the 1st, 41° on the 10th, 36° on the 16th, 40° on the 24th, and *34° on the 31st.*

ACCESSIONS

PLANTS AND SEEDS

Additions to the Collection of Dahlias (1927)

34 *Dahlia* roots, 16 varieties. (By exchange with Mr. E. W. Schaefer.)

28 *Dahlia* roots, 2 varieties, and 12 *Dahlia* plants, 12 varieties. (Given by Fisher & Masson.)

22 *Dahlia* plants, 5 varieties. (Given by Chemar Gardens.)

22 *Dahlia* roots, 9 varieties. (By exchange with Mrs. Carl P. Sherwin.)

21 *Dahlia* plants, 11 varieties, and 1 *Dahlia* root. (Given by Success Dahlia Gardens.)

21 *Dahlia* roots, 9 varieties, and 10 *Dahlia* plants, 6 varieties. (By exchange with Mr. Alfred J. E. Schmidt.)

18 *Dahlia* roots, 10 varieties. (Given by Mr. William Seltsam.)

16 *Dahlia* roots, 12 varieties. (Given by Mr. J. J. Broomall.)

14 *Dahlia* roots, 14 varieties. (By exchange with Dr. William A. Orton.)

14 *Dahlia* roots, 9 varieties. (By exchange with Dr. Marshall A. Howe.)

12 *Dahlia* roots, 12 varieties. (Given by W. Atlee Burpee Co.)

12 *Dahlia* roots, 4 varieties. (Given by Dahliadel Nurseries.)

10 *Dahlia* clumps, 10 varieties. (By exchange with Dr. R. Roberto.)

10 *Dahlia* plants, 8 varieties. (Given by Mr. W. H. Waite.)

10 *Dahlia* roots, 1 variety. (By exchange with Miss Delia W. Marble.)

9 *Dahlia* roots, 9 varieties. (By exchange with Mr. William H. McClelland.)

8 *Dahlia* roots, 8 varieties. (By exchange with Mr. Albert Parrella.)

8 *Dahlia* roots, 8 varieties. (Given by Mr. Herman Rindfleisch)

8 *Dahlia* roots, 4 varieties. (Given by Mr. Nathan A. Miller.)

7 *Dahlia* plants, 7 varieties. (Given by Fraser's Dahlia Gardens.)

6 *Dahlia* plants, 6 varieties. (Given by Mr. J. A. Kemp.)

6 *Dahlia* plants, 3 varieties. (Given by Mr. Louis Alling.)

6 *Dahlia* roots, 6 varieties. (By exchange with Mr. L. B. Ruggles.)

6 *Dahlia* roots, 3 varieties, and 4 *Dahlia* plants, 2 varieties. (By exchange with Mr Walter N. Corby.)

6 *Dahlia* roots, 2 varieties, and 3 *Dahlia* plants, 1 variety. (Given by W. W. Kennedy & Sons.)

5 *Dahlia* roots, 5 varieties. (Given by Thomas J. Murphy's Dahlia Garden.)

5 *Dahlia* roots, 5 varieties. (Given by Professor J. B. S. Norton.)

4 *Dahlia* roots, 3 varieties. (By exchange with Mrs. Edythe McDonald.)

3 *Dahlia* plants, 3 varieties. (By exchange with Mr. J. E. Du Bois.)

3 *Dahlia* roots, 3 varieties. (By exchange with Mrs. F. B. Lytle.)

3 *Dahlia* roots, 1 variety. (By exchange with Davis Peony Farms.)

2 *Dahlia* plants, 1 variety. (By exchange with Corby & Gould.)

2 *Dahlia* plants, 1 variety. (Given by Mr. Thomas H. Hughes.)
2 *Dahlia* plants, 1 variety. (By exchange with Dr. George C. McBride.)
2 *Dahlia* roots, 2 varieties. (By exchange with Dr. H. Trossbach.)
2 *Dahlia* roots, 1 variety. (Given by Mr. Ralph W. Clark.)
2 *Dahlia* roots, 1 variety. (Given by Dr. Clyde Fisher.)
2 *Dahlia* roots, 1 variety. (By exchange with Mr. Fred H. Lancaster.)
2 *Dahlia* roots, 1 variety. (Given by Mr. Curtis M. Redfern.)
1 *Dahlia* clump. (Given by Mrs. M. O. Howe.)
1 *Dahlia* clump. (Given by Mrs. U. G. Stockwell.)
1 *Dahlia* plant, and 1 *Dahlia* root. (Given by Mr. Fred A. Danker.)
1 *Dahlia* root, and 1 *Dahlia* plant, 2 varieties. (Given by Dr. F. R. Waite, Jr.)
1 *Dahlia* root. (Given by Mr. George Beck.)
1 *Dahlia* root. (By exchange with Mr. J. T. Butler.)
1 *Dahlia* root. (By exchange with Mr. Herbert D. Green.)
1 *Dahlia* root. (By exchange with Mrs. G. W. Wingate.)

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THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

VOL. XXVIII DECEMBER, 1927 No. 336

JOURNAL
OF
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A. B. STOUT

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JOURNAL
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WHY WE FAIL WITH GARDEN LILIES

In the average flower garden one rarely finds more than three or four sorts of lilies and in many cases there are none whatever. It is only in the gardens of those who make continued and rather determined efforts to grow different kinds of lilies that one sees as many as ten different varieties. If one asks why this is the case, the reply invariably is that lilies are difficult plants to grow, that it is almost impossible to keep them established in a garden, that many bulbs obtained for planting grow poorly or fail entirely, and that even after lilies thrive for several years they are liable to do badly and to disappear entirely. This appears to be the common experience of many who attempt to grow lilies in the region about New York City. It is a fact that little progress has been made during the past twenty-five years toward the more general and successful culture of lilies in the eastern part of the United States. We must recognize that, under the conditions operating at the present time, lilies are uncertain plants and that they are difficult to establish and maintain in garden culture. If lilies could be as easily grown as are irises, dahlias, poenies, and day lilies (*Hemerocallis*), there would be few gardens without at least ten of the most hardy and attractive kinds. It is indeed time that diligent search is made as to reasons for these failures and the measures that are necessary for the more successful and general culture of this group of attractive plants.

From the writer's experience in growing nearly fifty different kinds of lilies and in working with some 25,000 seedlings, and from observations of lilies in the gardens of others, all covering a period of fifteen years, it seems certain that there are three main reasons why it is difficult to establish lilies and to maintain them in garden culture. First, there is the matter of supplying proper

cultural conditions; second, there is the difficulty of obtaining good bulbs to start with; and third, there is the destruction of lilies by such agents as mites, pine mice, and most of all by diseases.

The Cultural Requirements of Lilies

Most of the difficulties experienced in the growing of lilies have, in the past, been attributed chiefly to unfavorable conditions of culture. It is no doubt true that some lilies are naturally delicate in growth and that certain lilies require somewhat special conditions of culture.

As a rule, garden lilies enjoy good drainage and a fairly rich well-worked soil, but these conditions usually exist in the average flower garden. They benefit by the protection of a ground cover of some shallow-rooted low-growing plant such as the Japanese *Pachysandra*. An interplanting with various perennials, providing partial shade to the soil in which the lilies are growing, is desirable for most lilies. A mulch of leaves or straw in winter will often prevent too severe freezing and thawing of the soil and the bulbs. When plants grow rather thickly together, of varieties that are abundantly stem-rooting, the soil above the bulbs soon becomes more or less filled with the dead roots of successive generations of plants and is much impoverished. In such cases it is advisable each autumn to work the soil down to the top of the bulbs, removing the dead roots and adding rich soil or fully decayed compost. Unless a group of lilies is multiplying so rapidly that the plants become crowded, there is no necessity to dig up and replant the bulbs of any lily that is properly planted. To supply these cultural conditions is not difficult: they have been supplied in gardens to lilies that have failed to grow well.

For several years the writer has held a notion that the association of mycorrhizal fungi in the roots of lilies may be a factor of importance to the successful culture of lilies. Mycorrhizas have been found[1] to be abundant in roots of various species flourishing in the wild, but the effect of their presence or absence in various garden lilies is not yet determined with certainty.

A better understanding of the various aspects of culture for many varieties of lilies is greatly to be desired. But for the pres-

[1] This fact was determined by Mr. E. G. Arzberger, of the Bureau of Plant Industry.

ent time it is to be recognized that there are some fifteen kinds of lilies—certainly at the very lowest figure, ten species—that will thrive under the average cultural conditions which are already given to them in many flower gardens. It is the repeated failure of these hardy garden lilies that is the chief concern at this time. In many cases, failure with these lilies cannot properly be attributed merely to poor cultural conditions.

The Difficulty of Obtaining "Good" Bulbs

The physical condition of lily bulbs at the time when they are received by the gardener is a most important factor in determining the success or the failure of the transplanting. The very best of cultural care is of no avail when the condition of the bulbs dooms them to a poor existence and an early death. Besides, to determine the best methods of culture with such bulbs is quite impossible.

The removal of lily bulbs from the soil for a period during storage and shipment is without a doubt chiefly responsible for bulbs becoming of poor condition. Lily bulbs do not naturally have a dormant or resting period, unless it be in midwinter. The death of the flowering stem above ground does not signify that the parts of the plant below the ground have become dormant. The new or daughter bulbs remain more or less active. They continue to develop and to prepare the flower stalk and its flowers for rapid growth in the following year. Many of their roots soon grow almost to their maximum development and they remain alive over winter, ready to resume their functions in the following spring.

When lily bulbs are dug for the trade, their roots are usually destroyed. The continued and proper development of the bulbs is retarded and hindered during the period of storage and shipment. When replanted these bulbs must form a new set of roots, and this they often do sparsely. Even under the best of the present-day methods of storage and shipment, lily bulbs lose considerable moisture, and the outer scales, especially, are more or less dried out, much bruised, and broken. Often the entire bulb is much shriveled. When the scales are rather fragile in attachment to the stem, as is the case for several species (*L. superbum,* for example), many of the scales may be broken from

the bulbs by the treatment they have suffered. Lily bulbs have come to The New York Botanical Garden from across the continent packed merely in coarse excelsior and from Europe packed

FIGURE 1. Bulbs of *Lilium longiflorum*.

Above: During storage and transportation, lily bulbs are without roots. The scales and the living bud within are liable to suffer greatly.

Below: Lily bulbs are frequently received with the outer scales badly decayed. The rot evidently begins in bruised areas.

in dry saw dust. These bulbs were either completely dried out or so nearly so that they were unable to grow. Bulbs have frequently come with the flower stem about to protrude from the bulb; the conditions of storage or during shipment started a premature elongation of the flower stalk.

The poorest of such bulbs fail entirely to resume growth. Others in somewhat better physical condition will make a weak growth of new roots and a flowering stem may show above ground with only blasted flowers or with few poorly developed flowers. The continued existence of such plants is scarcely to be expected. In the case of many bulbs that make a rather satisfactory flower stalk in the first year after they are transplanted there is a weak growth of new roots and a failure to form a new daughter bulb necessary for the continued life of the plant. The plant blooms once only and spends all the strength of the mother bulb in this one effort. It is only when a rather vigorous growth is made in new roots from the old bulb and in the development of a side bud into a sizable daughter bulb sufficient to bloom the following year that the transplanting is successful and the lily plant is established in the garden. In the treatment of lily bulbs the fact that a living plant is being transplanted needs to be emphasized and ever remembered.

Frequently lily bulbs received for planting are much decayed, either with a soft or a dry rot, depending on the conditions of moisture. It is not easy to determine whether such bulbs have started to die because of the treatment they have suffered or whether they are dying because of the attacks of parasitic fungi or bacteria. The extent to which these two main causes of decay are operating and their relations to each other remain as important matters to be determined. It is to be remembered that when scales begin to die from bruises or excessive drying, decay follows inevitably. Many lily bulbs are partly dead when received for planting. While the inner scales and the bud of the bulb may be still alive, the bulb is often in such condition that it can only grow feebly and can continue in existence for a short time only.

It is considered by some that bulbs are over-forced by bulb growers in the effort to obtain bulbs of extra size for the market and that this practice weakens bulbs, makes them more susceptible to disease, and leads to the poor development in following years.

On this assumption gardeners have been advised to purchase only medium-sized bulbs. It does not appear that this important matter can be decided in a fully satisfactory way from the evidence now at hand.

The physical condition of the lily bulbs received through the trade for garden plantings can be greatly improved. The length

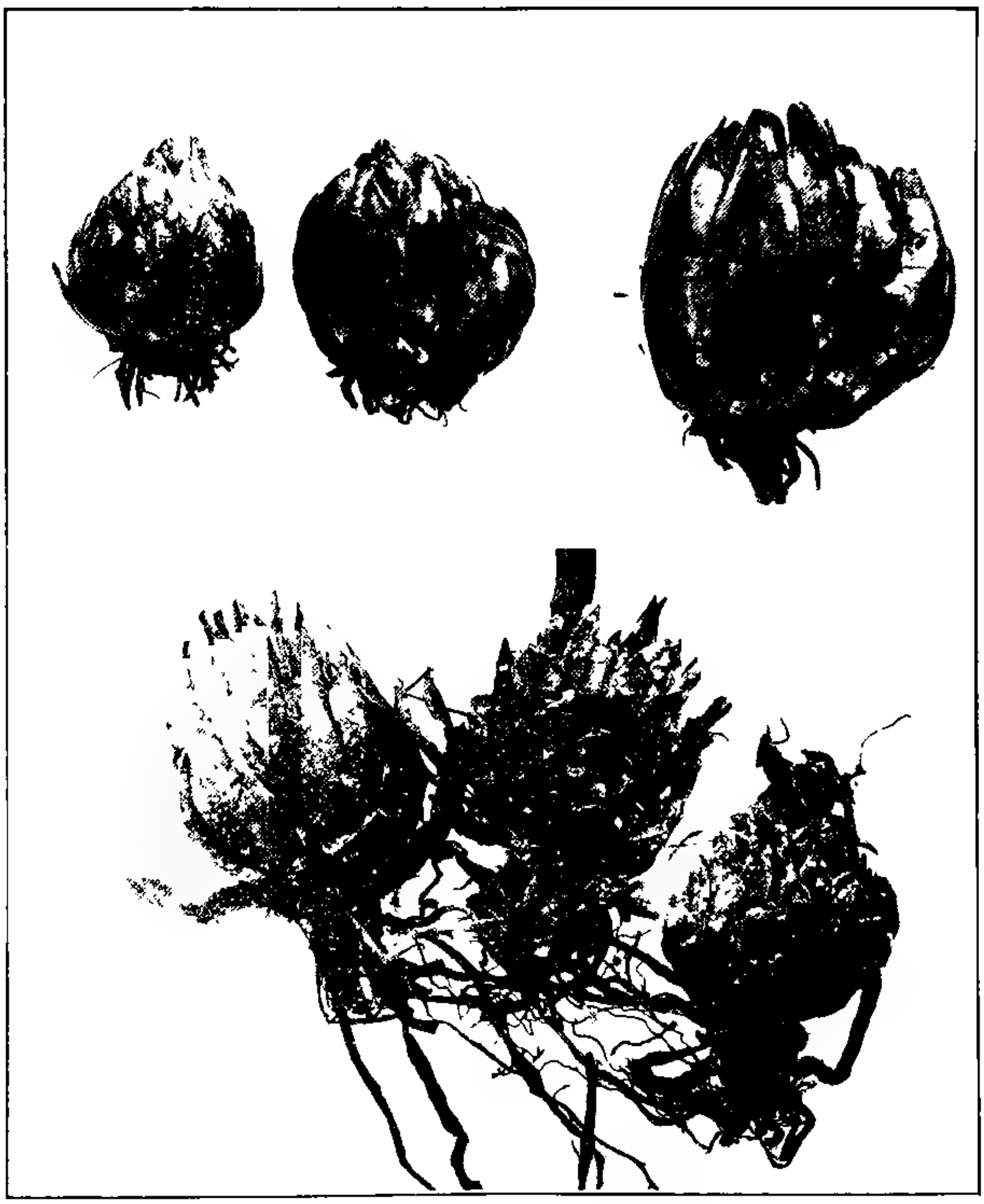

FIGURE 2. *Above:* Bulbs with flower stalk slightly protruding at the time the bulbs were received. No growth appeared after they were planted. *Below:* Bulbs that had been shipped from Europe packed in dry sawdust. They were completely dried out and dead when they arrived in New York City.

of time they are kept out of the ground should be reduced to the shortest period possible. Better methods of storage and of shipment can no doubt be employed. But lily bulbs, especially of certain species, do frequently come to the grower in good condition, which shows that if the best methods of handling bulbs now in use can be more rigidly followed greater success may be assured. At least there is no excuse for the use of coarse excelsior or sawdust as a medium for packing lily bulbs. Perhaps bulbs could be shipped, certainly for shorter distances, with the roots intact in the soil more or less as they were growing. The gardener, or two or more gardeners together, can buy lily bulbs in case lots. Then the bulbs will come to hand more promptly and will escape the injuries that result from the repacking necessary for distribution to the trade when small lots are ordered. Any dealer in bulbs will be willing to sell bulbs in case lots and he can do this at cheaper rates per dozen or hundred. The matter of handling bulbs, and especially those of garden lilies, deserves careful consideration.

The Destruction of Living Lilies

The disappearance of lily plants that have been flourishing in a garden for several years is a frequent matter of discouragement to the gardener. There are various causes for this experience.

Certain of the lilies habitually make only one new daughter bulb each year. Such plants do not readily multiply and give an increase in the number of flower stalks in successive years. Whenever conditions arise that check or prevent the formation of a new daughter bulb by a single lily plant, that plant disappears. An unfavorable season for growth during critical periods in the development may give rise to this condition. The bulbs of some lilies, among garden lilies, *L. tenuifolium,* for example, have the reputation of blooming only once or at best only a few times. Such species are to be propagated from seed or by special vegetative propagation. It will probably always be necessary for gardeners to replenish rather frequently their stocks of those lilies that do not readily make new daughter bulbs. But we are to be reminded that there are a number of species which naturally multiply and which will sometimes remain established in a location for a number of years. Among such species may be mentioned *Lilium tigrinum, L. Henryi, L. croceum, L. regale, L. candidum,*

and *L. speciosum.* Among the species that do not usually multiply but which may remain in much the same numbers year after year, *Lilium auratum* and *L. superbum* may be mentioned. It is the sudden disappearance of such species as these after they have become established in a garden that challenges attention and demands solution.

In certain sections of the country pine mice are very destructive of the bulbs of lilies. These rodents live chiefly in the soil, driving their burrows to considerable distances and feeding freely on the roots, underground stems, and bulbs of various plants. They are very fond of the sweet luscious bulbs of many lilies, and in some localities where they are numerous it is almost impossible to grow lilies. It is difficult to combat these animals except with poisoned bait placed in their underground runs. A bulletin[2] issued by the U. S. Department of Agriculture recommends the use of sweet potatoes cut into pieces and liberally coated with powdered alkaloid strychnine or of strychnine-coated wheat which is placed in the runways of the mice or in small caches near the bulbs.

The bulb mite (*Rhizoglyphus Hyacinthi* Banks) infests lily bulbs and causes injury, decay, and death to them, both during storage and after they are placed in the soil. This mite is so minute that it can be seen only with the aid of a magnifying lens. The greenhouse thrip (*Heliothrips haemorrhoidalis* Bouche) does much damage to the bulbs, stems, and leaves of lilies grown in greenhouses and in hot and cold frames. It has been the practice at The New York Botanical Garden to immerse lily bulbs before planting them in a solution of one part 40 per cent. nicotine sulphate and 400 parts water for a period of five minutes. This has been done in the attempt to destroy mites and thrips that are on the bulbs or among the scales at the time of the treatment. The matter of attacks on lilies by mites and thrips challenges the attention of the growers of lilies as to the extent of the injuries, the ready recognition of symptoms indicating their presence, and the best means of control.

One disease of lilies, that caused by the gray mold or *Botrytis* fungus, has been recognized and the causal organism known since the studies of Marshall Ward in England some forty years ago. This fungus may do considerable damage to the flower buds, the

[2] Farmers' Bulletin No. 1397.

FIGURE 3. At the left, *Lilium auratum*; at the right, *L. speciosum*. Plants showing several stages of a disease, at present unknown as to cause, that is very destructive of lily plants.

flowering stems, the leaves, and the bulbs. This fungus can be seen; its growth on and in the plants can be observed; it can be grown in artificial culture. Its mycelium penetrates into the tissues of the host and spreads over the surface as a gray mold forming decayed and somewhat watery areas in leaves, stems, and bulbs. Sprays of the Bordeaux mixture applied to foliage and to the surface of the soil will in large measure destroy the fungus. When this disease is present, the use of partly decayed manure and vegetable matter in the soil or on the surface is to be avoided. This fungus is nearly always to be found in gardens and the use of raw manures or of poorly decayed compost in the bed of lilies is liable to bring it to the plants.

It is to be recalled that some years ago a disease wrought havoc in the lily fields in Bermuda and practically effaced the flourishing industry of producing bulbs of Easter lilies for the trade. Many attempts to continue and to revive the industry failed dismally. Efforts to determine the nature and the cause of the disease also failed, chiefly because the causal organism could not be found. For years the disease remained somewhat of a mystery.

Meanwhile, definite knowledge began to accumulate regarding a class of plant diseases now known as "virus" diseases. It was shown that these diseases exist in the juices of plants, that in some cases the filtered sap of diseased plants can transmit the malady, and that in numerous cases insects, such as plant lice and leaf-hoppers, rapidly spread the disease. If an organism is present in the sap it is so minute that it is not to be seen by present methods of microscopic examination; if no organism is present there is something akin to a living fluid that is involved.

These virus diseases are to be recognized by various symptoms such as the yellowing, the mottling, the crinkling, and the dwarfing of leaves, by the stunting of the entire plant, and by the death of certain parts of the plant. The entire plant may die or fail to propagate itself, especially when it happens to be a perennial depending on vegetative means of propagation. Virus diseases do great damage to many ornamental and economic plants such as asters, potatoes, sugar-canes, tobacco, and cucumbers. They are present among many wild species of plants, even in certain of the weeds of the waste places. For this type of disease the most effective methods of control yet devised are the immediate de-

struction of diseased plants to remove the sources of the disease and the use of sprays or dust to kill the insects that transmit the virus from diseased plants to healthy plants.

Only recently has it been determined through careful studies made in Bermuda that the hitherto undetermined lily disease of that island is a virus disease.[3] Already gratifying results are to be seen there from the use of remedies to the benefit of the bulb-growing industry and the business of forcing such bulbs into flower for the trade.

In the course of the writer's work with lilies the accumulated stocks of certain species and even of rather large collections of plants have at several times suffered severe loss, at times even to the point of complete extinction. This has happened most conspicuously to stocks of *Lilium auratum,* and hence special attention has been given to the conditions and the symptoms attending their death. At first it was thought that cultural conditions were at fault, but it soon became more and more evident that a disease of some sort was present and spreading among the plants. Certain lots of bulbs were obtained in excellent condition and readily established in garden culture. After they had continued as splendid plants for several years, disease appeared as a " blight " in the upper part of the plant effecting the death of flower buds, the upper portions of the stem and the leaves, and progressing downward through the flowering stem toward the bulb. The disease seems to spread from plant to plant and to be very widely spread during the early summer.

Badly diseased plants fail to bloom and soon die to the ground. They usually do not appear above ground in another year or if they do their growth is poor and death is complete by the following year. The same course of events was also seen in plants of *L. speciosum.* Other lilies exhibit somewhat different symptoms in disappearing which suggests either a different response to the same disease or the presence of two or more different diseases—all evidently of virus nature.

During the past ten years over 500 different lots of lily seeds have been planted at The New York Botanical Garden and a total of at least 25,000 seedlings obtained. In many cases seedlings have thrived for about two years and then a rather decided decrease in number occurred. The spread of disease among these

[3] Agricultural Bulletin, Bermuda Dept. of Agr. 5: 6. D 1926.

seedlings has without doubt been the main cause of this wholesale loss of plants. But splendid plants of various species and of certain hybrids have readily been reared to blooming age under various methods of culture, which indicates that the failures are not due simply to cultural conditions. The use of solutions of the mercurial compounds now in the market and of value in treating for various fungous diseases has shown no beneficial results in our work, either when used as a bath for bulbs or when applied directly to the soil of seed pans or cold frames. Such treatment would scarcely be of any value in combating virus diseases.

At the present time very little can be said further than that mentioned above regarding the diseases of lilies. This is an admission that the knowledge of lily diseases is rather meager, incomplete, and unsatisfactory. Fortunately, a study of lily diseases is now in progress under the active coöperation of The Horticultural Society of New York, the Boyce Thompson Institute for Plant Research, The New York Botanical Garden, and the Department of Plant Pathology of Cornell University. An investigator, Mr. Carl F. Guterman, has been secured and is now devoting nearly all of his time to the subject of lily diseases. It is expected that he will be able to determine the different diseases of lilies, to describe their symptoms, and to prescribe means of treatment. Results of much practical value to gardeners and to the bulb industry are certain to be obtained and freely given to all. The successful and more general culture of lilies, at least in the vicinity of New York City, awaits such knowledge.

It is to be noted that lily bulbs are not necessarily diseased or inoculated with the viruses of diseases at the time they are distributed in the trade. It may be, however, that a certain percentage of such bulbs carry disease. This is a matter that is of vital concern wherever lily bulbs are produced for the trade.

The time must come when the home gardener can be supplied with bulbs free from disease and in such a good physical condition that they will have a reasonable chance to survive the transplanting. The time must come also when the various diseases are recognized and are more successfully controlled in gardens. Then methods of culture can be perfected and a greater number of species can be grown in a greater number of gardens. Lilies will then become plants of more general culture.

A. B. Stout.

THE CAMPAIGN AGAINST DISEASES OF OUR FOOD PLANTS[1]

The increasing demand for fresh fruits and vegetables on the city tables winter and summer necessitates a never-ending struggle by growers, distributing agencies, and transportation companies against diseases of our food plants.

The extensive development of agriculture in any country is likely to be accompanied by an influx of plant diseases. Just as congestion of human population favors the spread of diseases, long-continued cultivation of any single crop in a region usually results in an increase of plant parasites. Consequently, it sometimes happens that by the time such a crop reaches a place of major importance in a community, the presence of one or more plant diseases has introduced an unwelcome element of uncertainty in plans for production. Indeed, unless successful control measures are adopted it may be necessary for farmers to change to some other type of agriculture. This sometimes leads to the necessity of abandoning or moving equipment installed for processing locally grown plant products. Within the past ten years the mosaic disease of cucumbers has been so severe in some sections of the United States as to force pickle-packing companies to abandon certain infested territory as locations for their salting stations. Likewise the cabbage yellows disease has occasioned heavy losses to kraut packers owning factory equipment in the vicinity of fields which have become infested with the causal organism. Similar examples can be cited from almost any field of canning operations.

When we consider the fact that the initial cost of a pineapple cannery or a sugar mill sometimes approaches the million dollar mark, one can readily understand the necessity of doing every thing possible to insure good crops.

Heavy Reductions in Yield Caused by Disease

In order to understand the profound effect which plant diseases may have on the agriculture of a community, one should have a general idea of some of the types of loss more commonly experienced. Perhaps the most obvious effect is that of reduction of

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, October 22, 1927.

yield. It has been estimated that, during 1925, farmers in the United States lost approximately 86,000,000 bushels of potatoes and more than 22,700,000 bushels of apples due to reduction of yields caused by plant diseases. Losses due to disease, whether in the field or in transit, reduce the return received by the producer and increase prices which must be paid by the consumer.

Although the effect of some diseases is, for the most part, limited to reduction of yield in the field or grove, others not only cut production, but cause blemishes of the fruit, making it either unmarketable or at least throwing it into a low grade. Nail-head spot of tomatoes is a good example of this sort of thing.

Still other diseases may cause some damage to the growing plant, and, what is still more important, affect the harvested crop in such a way as to cause decay in storage or during transit. To the wastage caused by this latter type must be added destruction brought about by fungi which, although they are not known to attack actively the growing plant in the field, are nevertheless responsible for enormous losses during the marketing period. Decay of fruits and vegetables occurring during steamship and railroad transportation costs the consumer, transportation companies, and producer tremendous sums each year.

Millions Lost During the Marketing Period

As evidence of the importance which should be attached to wastage in transit we have the figures given to us by the American Railway Association on claims paid during the past few years. Fresh fruits and vegetables, an item amounting to but 1.27 per cent. of total tonnage, cost the railroads in 1926 more than $8,200,000, or 21.6 per cent. of total claims paid on all commodities. Much of this loss was caused by plant diseases. In addition to the damage included in this item, we have much wastage on the wholesale and retail markets.

It is evident that if an agricultural community is to compete successfully with other such communities, these field, storage, and transit losses must be kept at a minimum.

Research Brings Methods of Preventing Losses

Realizing this, state experiment stations, the U. S. Department of Agriculture, and other institutions have for years conducted

research aimed at the advancement of knowledge with regard to plant disease control. More recently, private industries, recognizing the relation of disease control to the profits of their enterprises, have here and there employed plant pathologists to assist in solving their production and transportation problems. The result has been a gradual accumulation of facts on which plant pathologists have been able to base certain control measures.

It should be remembered that with persistent research, new and improved methods are constantly being found. Spraying and seed treatment as means of disease control on a specific crop may turn out to be unnecessary, due to the development of varieties which are resistant to the disease. A difficult and disagreeable wet seed-treatment may give way to one that is more convenient, less difficult to apply, and, at the same time, more effective than the old one. For throughout the world we have a constantly increasing number of plant pathologists working to discover new facts which will lead to more successful methods of control.

Organization of Extension Work in Plant Pathology in the United States

It can readily be seen that with the growth of knowledge concerning disease control the problem of keeping the farmer acquainted with the latest developments and methods of taking advantage of them becomes increasingly difficult. For over fifty years in the United States the more important findings of research have usually been quite promptly put into popular printed form and made available to the public as State or Federal bulletins. These are distributed free of charge to the farmer or any other interested person. Thus farmers have had within their reach the latest information in regard to control methods. In spite of this service, it often happens that losses continue to be serious. It has been found that farmers may be fairly well informed in regard to a disease and still fail to take advantage of the available control methods. As one studies this problem, it is apparent that the farmer must not only be taught the facts, but that these facts must be presented to him in such a way that he can clearly see their practical relation to his problem. Having decided to adopt the method, he must be shown how to carry out the necessary program in an effective way, so that the disease control measure will

be profitable to him and to the community. Recognition of the need of this sort of assistance to farmers has led in the United States to the development of extension work in plant pathology. The general aim of the work is to increase the efficiency of production, maintain high quality of plant products, and prevent wastage in storage, transit, and at the market.

Education of Farmers Brings Results

This work has led to a rapid advance in plant disease control, particularly along the lines of introduction of resistant varieties, seed disinfection, spraying, and seed selection.

In the field of control by use of disease-resistant varieties, great progress has been made in connection with the introduction of wilt-resistant strains of tomato, cotton, and cabbage, rust-resistant asparagus, root-rot resistant tobacco, and blight-resistant spinach. Generally, in territory where disease-resistant strains of plants can be used to advantage, it has not been difficult to induce farmers to grow them. In such localities the work, for the most part, has passed beyond the demonstration stage and the problem is to establish a source of seed supply of a type to meet the local market requirements. This has been accomplished through maintenance by the Department of Agriculture of a pure-seed stock of certain resistant varieties of tomatoes and asparagus, and in the case of cabbage by the Department of Agriculture and the University of Wisconsin. The departments of plant pathology in some States have developed strains of resistant plants which meet local requirements. This pure-seed stock is usually made available by the Government and States to reliable seedsmen for multiplication.

For some diseases, seed treatment combined with rotation to insure planting on disease-free soil is the only practical control measure known. Other diseases, such as angular leaf spot of cucumber, when not distributed in a growing section, may be controlled by a cheap seed disinfection, making unnecessary the use of a spray, which at best is only partially effective. For certain other troubles, seed treatment is but one of several means of control which are necessary to insure a satisfactory reduction of loss. An interesting feature of this work has been the way in which extension pathologists have taken advantage of the fact that most seed-treating operations can be centralized. It is obvious that if

the work for a great many farmers is centralized at one point, it can not only be supervised more closely to insure accurate timing and correct preparation of chemicals or solutions used, but it can be done more economically. Such treatment gives maximum control with a minimum of seed injury. Moreover, the enthusiasm that prevails when men are brought together to do such work can be used to advantage, with the result that more farmers will treat their seed than if the work were done on individual farms. Seed treatment of potatoes, sweet potatoes, cabbage, tobacco, wheat, and many other crops has grown rapidly as a result of extension effort within the past ten years.

Work in connection with spraying and dusting operations has required considerable time. This is due to the fact that if these measures are to be effective and profitable the fungicide must be prepared accurately and applied correctly within a definite and limited period, a period which depends on such matters as condition of fungous and insect pests, state of development of the plant, and variations in weather. The fact that conditions which influence the time of application and the choice of spray mixtures to be used are likely to differ somewhat each season, necessitates constant watchfulness on the part of plant pathologists and entomologists to determine the appropriate sprays and the critical times for their application.

As to selecting seed free from disease, the most important activities have perhaps been in connection with efforts to control the virus diseases of potato and the root, stalk, and ear rots of corn. In the case of these two problems, recent research followed by extension activities has aided farmers by creating a new farm enterprise, the production of disease-free or certified seed.

Business Agencies Join in the Campaign against Disease

In closing his talk, the speaker told of the wheat smut control campaign which has been under way in some thirty-five wheat-growing states this year. Aroused by the increase in damage done by wheat smut, farmers, millers, elevator managers, railroad officials, bankers, newspaper men, in fact all business groups interested in successful farming, are joining hands with State and Federal workers in an effort to introduce the new copper carbonate seed treatment for the control of this disease. This work affords

an excellent example of the way in which research in plant pathology, linked with extension activities, may serve the practical needs of the public.

More Research Needed

Although research and extension activities carried on by State and Federal agencies have already done much to reduce the hazards created by plant diseases in the industry, the opportunities for work in this field were never so great as at present. Increased cost of labor and other items connected with production, the practice of selling many plant products according to grades which are based in part on degree of freedom from disease, and the prevailing high freight rates make desirable the efficient production of high-grade products that can be transported without excessive wastage. More general application of disease-control measures is one of the necessary steps by which this result can be obtained.

More than fifty lantern slides, many of them in color, were used to illustrate this talk. Among these were colored photographs prepared to illustrate the wastage of fruits and vegetables during the marketing process, as well as numerous pictures taken by the speaker in the course of his travels throughout the farming country of the United States.

F. C. Meier,
Extension Pathologist,
United States Department of Agriculture.

CHARLES FREDERICK RAND

Through the death of Mr. Charles Frederick Rand, on June 21, 1927, The New York Botanical Garden lost a member of its Board of Managers who had served since 1924; he had been a member of the Corporation since 1914. He was much interested in the development of the Garden, and frequently contributed to funds needed for various purposes. His major interests were in mining; during our botanical explorations in northeastern Cuba, he greatly facilitated the work of Dr. J. A. Shafer, one of our collectors, in the vicinity of the iron mines at Woodfred, near Antilla; he is commemorated in botany by the sedge *Rynchospora Randii,* endemic in the Sierra de Nipe, discovered by Dr. Shafer while exploring that mountain range botanically.

The following resolutions were adopted by the Board of Managers at their meeting on November 17, 1927:

Resolved, That the Managers of The New York Botanical Garden deplore their loss by the death of their esteemed associate, Charles Frederick Rand; and,

Resolved, That the foregoing preamble and resolution be published in the JOURNAL of the Garden.

N. L. BRITTON,
Secretary.

PUBLIC LECTURES DURING DECEMBER AND JANUARY

During December and January, the free public lectures of The New York Botanical Garden take the form of talks and demonstrations in the Central Display House of Conservatory Range No. 2, beginning at 3 o'clock on Saturday afternoons. The program follows:

December 3. "Air-Plants," Dr. H. A. Gleason.
December 10. "Winter Birds in the Botanical Garden," Mr. R. S. Williams.
December 17. "Ferns," Dr. Marshall A. Howe.
January 14. "Australian and South African Flowers," Mr. Kenneth R. Boynton.
January 21. "House Plants and their Care," Mr. H. W. Becker.
January 28. "Planting Flower Seeds," Mr. George Friedhof.

Conservatory Range 2 is situated at the eastern side of the Botanical Garden, north of the Allerton Avenue Entrance. It is most conveniently reached from the Allerton Avenue Station on the White Plains Extension of the Subway from East 180th Street. Visitors coming by train to Botanical Garden Station should inquire at the Museum Building.

NOTES, NEWS, AND COMMENT

Dr. H. A. Gleason spent a week in early November in studies at the Gray Herbarium, in Cambridge, Massachusetts.

The dahlia season of 1927 at The New York Botanical Garden was a long and successful one, the first killing frost being de-

ferred until November 8, making five years out of the last ten (1918-1927) that the dahlias have reached November in excellent blooming condition. The dwarf bedding variety Coltness Gem was in continuous bloom for a period of nearly four and a half months. A rainfall of nearly 22.5 inches for the two months beginning July 2 and ending September 1 and of 7.81 inches in October was perhaps too much of a good thing for some parts of the Dahlia Border, but the general profusion and excellence of the flowers bore out the common belief that dahlias thrive best when they receive plenty of rain during the blooming period. The collection included nearly 1,000 plants, representing about 425 of the choicest modern varieties.

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 35,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific, and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
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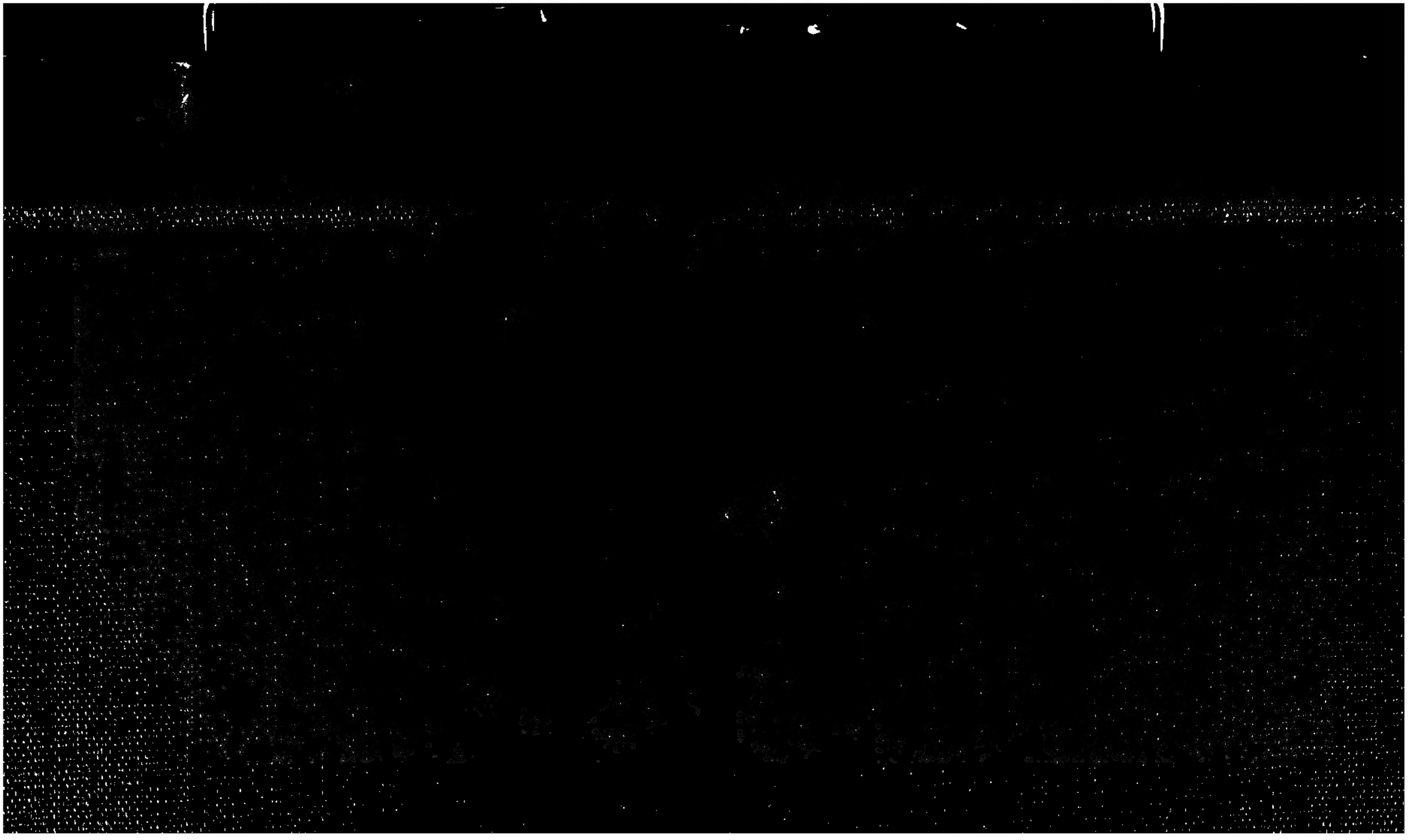
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